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THE PRACTICAL TEACHER

CHAPEL OF ST. JOHN'S, CAMBRIDGE.

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OF THE

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A MONTHLY MAGAZINE AND REVIEW

FOR THE SCHOOL-ROOM AND THE STUDY

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CAMBRIDGE AND ITS UNIVERSITY.

HISTORICAL AND TOPOGRAPHICAL NOTES FOR THE VISITOR.

THE history of every town, if we can trace it back to the remote past, is almost certain to find its roots in the physical features of its site, and something of this is commonly preserved in the name of the place. It is so with Cambridge, the name of which, every schoolboy will tell us, indicates a place where a bridge crosses the river Cam.

The river was, however, originally called the Granta, and the name of the village on its banks in the ninth century was Grantabryege, being given in the Anglo-Saxon Chronicle as Grantanbryege. In the twelfth century this had become Cantebrigge, which by ordinary euphonic changes speedily became Cimbrugge. The river retained its original name for a long period, but it now survives only in a journal.

The Romans had a station at Castle Hill, the terrace of Magdalene College being a portion of the rampart. The position at the junction of the two great roads, Akeman Street and the Via Devana, made it of great strategic value.

Successive stages in the town's history are indicated in many of the buildings and institutions, which date from centuries back. Thus, the Church of St. Benedict shows by its tower the occupation by the Saxons; and the Conqueror built a castle as a base from which to operate against Hereward, in the Isle of Ely. The great change that has taken place by draining is apparent when it is remembered that, in the time of Henry the First, Cambridge was one of the great customs ports of the north-eastern portion of East Anglia.

The nunnery of St. Rhadegund, founded about 1133, has now become Jesus College; Frost's Hospital of St. John has developed into St. John's College; whilst the old synagogue, a foundation of the Grey Friars, is now the site of Sidney Sussex College, and the site of the house of the Friars' Preachers is the site of Emmanuel.

The Merchants' Guild of 1200 became a perfect corporation with the mayor and four bailiffs by 1231, the common council appearing first in 1377.

The strife between town and university, which was continually breaking out, culminated in 1381 in a tumult which finally cost the town many of its privileges and enlarged those of the university.

In 1574, 1625, and 1630 the place was ravaged by the plague. In the latter year the assizes were held at Royston, and the students were sent down.

Cromwell twice represented the town, and Fairfax, the Parliamentarian general, was received with great honour at Trinity, and entertained at a banquet by the corporation.

A century ago Stourbridge Fair was the largest and most important in the country. In Saxon times Irish merchants brought cloth, and King John granted the tolls and profits to the Hospital of St. Mary Magdalene—now represented by Stourbridge Chapel, an interesting specimen of Norman work—which moneys were diverted to the corporation by Henry the Eighth. At the present time it is a single-day horse fair.

The Guildhall, where the Conference is to be held, is on the south side of the market-place; a plain, dismal-looking building, externally altogether unworthy of the town. Inside the accommodation is good, there being a large assembly room with a fine organ and richly-decorated roof. There are four other rooms, which are used for various civic purposes. At the back is the Free Public Library, comprising lending and reference departments and a commodious reading-room.

Across the road is the Corn Exchange, opened in 1875, where the Publishers' Exhibition will be held, and in the annexe an exhibit of decorative art for schools will be arranged.

It is not possible within the space

Next Month:

An Illustrated Account of a Visit to

THE UNIVERSITY CORRESPONDENCE COLLEGE.

at disposal adequately to deal with the twenty-one places of public worship; but some of them are specially interesting to visitors.

The Roman Catholic Church, Hills Road, dedicated to Our Lady and the English martyrs, is a very fine modern example of Early Decorated work. It was completed in 1890, from designs by Messrs. Dunn of Newcastle, and the entire cost was borne by Mrs. Lyne-Stephens. It is well worth a visit, from its intrinsic beauty.

At St. Mary the Great, in the market-place, the University has for centuries been accustomed to hold its special functions connected with public worship.

The Church of the Holy Sepulchre, in Bridge Street, is undoubtedly the oldest of the four round churches in England, having been consecrated in 1101.

At St. Benedict's, Benet Street, the oldest building in the town, there is a tower which is certainly pre-Norman; and in its south aisle is preserved an ancient fire-hook for unroofing thatched houses in case of fire.

Near Castle Hill is the Church of St. Peter, one of the smallest in England, with a most grotesque font on an equally absurd pedestal.

Trinity Church was the place of baptism of Jeremy Taylor, and has some good tablet memorials—the most interesting perhaps being that to Sir Robert Talbor, the first user of Jesuit's bark (quinine) as a remedy for fever.

The Church of St. Andrew the Great is interesting from the connection therewith of Captain Cook, the great navigator.

Hobson, the famous carrier of Cambridge, was a great benefactor of the town, and the curious structure at the junction of Lensfield Road and Trumpington Street, which for two hundred years stood in the market-place, is associated with his name. The water which runs down the sides of some of the streets, and supplies Emmanuel and Christ's baths, comes from this conduit, to which it is brought from a spring near Shelford.

Few towns possess so fine a piece of recreation ground as Parker's Piece, which formerly belonged to Trinity College, and is named after a cook of that establishment who had the lease.

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The first college (Peterhouse) was started at the close of the thirteenth century by the Bishop of Ely, who bought two houses in Trumpington Street and gave land for endowment. There are now seventeen such corporations, each of which has its own seal, arms, and academical dress, and is, within its walls, supreme in matters of discipline and tutorial arrangements. The heads of houses are mostly called masters; but King's has a provost.

The supreme governing body is the Senate, which is constituted from the resident members of the University who have taken the degree of M.A. or some higher degree. The proposals made to the Senate by the council of the Senate are called "graces;" and one curious feature is that, though the Senate may discuss, refer back, and reject, they cannot amend. Another peculiarity of Cambridge is the discussion of important matters by fly-sheets, which seem to have little effect except that of increasing the income of the local printers.

There are committees (called syndicates) for various purposes, the vice-chancellor being chairman of each of them. The principal officer is the chancellor (Duke of Devonshire), whose powers are usually delegated to the vice-chancellor (Dr. Hill, Downing), who is chosen by annual election from the heads of colleges, and usually holds office for two years. In the streets discipline is in the hands of the proctors, who are appointed from fellows of the various colleges in rotation. There are two under and two assistant proctors. When on duty, each proctor is accompanied by two attendants, who are commonly known as "bull-dogs."

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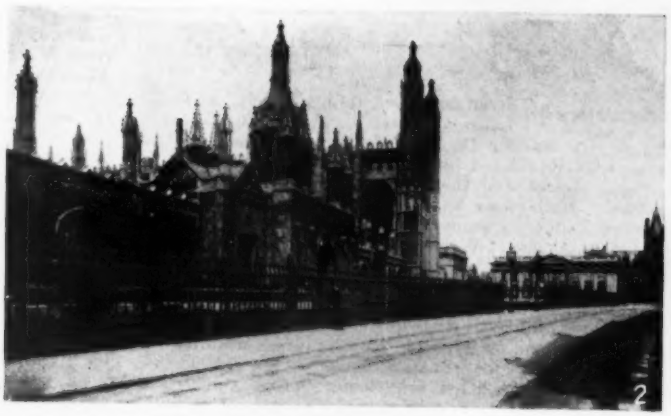

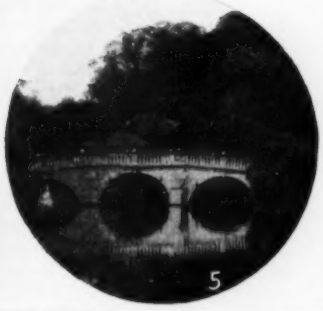

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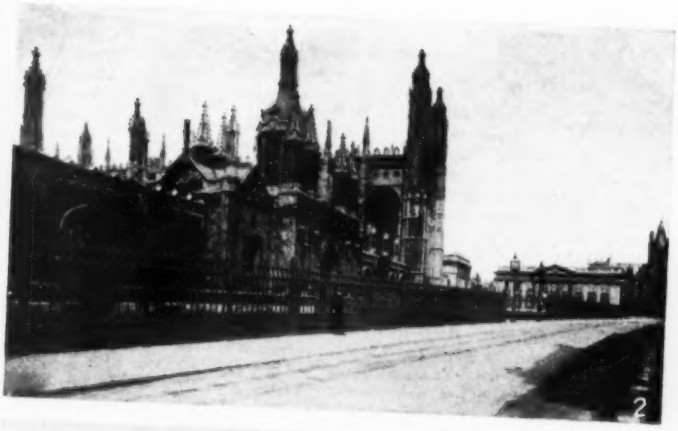

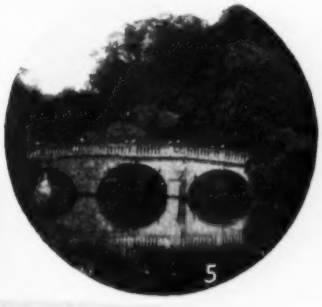

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SOME CAMBRIDGE COLLEGES AND SCHOOLS.

BY F. L. GREEN,
Sometime Scholar of Newnham College.

I.

Girton College.

"FROM small beginnings" might, in sound Latin, very well be the motto of Girton College. On October 16, 1869, six Girton pioneers settled very quietly in a hired house at Hitchin. There was then no Sarah Grand, and the new woman was not seriously regarded. Such dons as thought of marriage admired Coventry Patmore's women. A whole army of prejudices guarded Cambridge. Women might found colleges, but not study at them.

Very quietly, thirty miles away, Girton pioneers watched the Cambridge schools, modestly passed informally the "Little Go"—rather to their own surprise—and began unobtrusively to read for Triposes. With courage storming the citadel, one read for mathematical honours, two read classics. In 1873 Girton gained her first Senior Optime, and two of her students were informally judged "worthy of classical honours." From year to year, through the courtesy of individual examiners, Girton students were informally presented for examination in Triposes. The same conditions as to residence and the passing of preliminary examinations required for undergraduates were always insisted on by the college.

Girton is usually known to the American stranger as "the workhouse on the Huntingdon Road." Its dark-red brick buildings are in the French château style. Small at first, the college could only contain twenty-one students. It has been added to from time to time, and now contains rooms for the mistress, vice-mistress, junior bursar, six resident lecturers, and one hundred and six students. There are twelve lecture-rooms, a library, a reading-room, a dining-hall, and a chemical laboratory.

The library has an oak floor, and is used for dancing. Amongst its most valuable possessions are the works of Ruskin and Tennyson, presented by the authors, and the mathematical library of Mrs. Somerville, given to the college, after her death, by her daughter.

In the hall there are portraits of Miss Emily Davies and Madame Bodichon, two of the founders of the college. There is also a copy of Richmond's portrait of the Dowager Lady Stanley of Alderley, one of its earliest benefactors, to whom the college owes, among other gifts, the laboratory and £1,000 towards the building of the library.

There have been three mistresses of Girton—Mrs. Manning, Miss Bernard (Mrs. Latham), and Miss Welsh. The original entrance to Girton was down a lane thick with berries, and the clock which still stands over the gateway is a memorial to the first mistress.

The outlay on the college land and buildings has amounted to about £70,000, and plans for additional buildings have been provisionally adopted, to be carried out as soon as the college can do so. The present dining-hall will be annexed to the library; a new dining-hall and kitchen department, a chapel or prayer-room, and additional lecture-rooms are to be added. Rooms will also be added for a considerable number of students, and additional accommodation will be given to the lecture staff. A fund has also been raised by separate contributions for the erection of a swimming-bath.

Every Girton student, before coming into residence, passes either an Entrance Examination or some examination accepted as equivalent by the college. The Entrance Examination is held in London in March and in June. The necessary part of it consists of Arithmetic, History of the English Language, Elementary Latin, Elementary Euclid and Algebra, the New Testament, and one of the four following subjects: French, German, Greek, Euclid, and Algebra. The chief examinations that may be substituted for the Entrance Examination are the London Matriculation, the Cambridge Higher Local, the Oxford and Cambridge Leaving Certificates, the Senior Oxford or Cambridge, the Preliminary Examination of the Victoria Examination, the Edinburgh Senior Local Examination, the Aberdeen Senior Local Examination, the Preliminary Examination in Arts and Science of the Scottish Universities, the Matriculation Examination of the Royal University of Ireland, the Matriculation Examination of the University of New Zealand, the Matriculation Examinations of the Universities of Calcutta, Bombay, Madras, Allahabad, and the Punjab.

Scholarships and exhibitions are awarded for proficiency in Classics, Mathematics, Natural Science, and Modern Languages. There is a Clothworkers' Exhibition of the annual value of £60, for three years and one additional term, offered to candidates whose means are inadequate to cover the whole cost of their college education, preference being given to those engaged in or preparing for the profession of teaching; two scholarships offered by the Drapers' Company, of the annual value of £60 and £45, for three years; a scholarship offered by the Skinners' Company, of the annual value of £50, for three years; and the Pfeiffer Scholarships, each of the annual value of £30, for three years. Two scholarships, each of the value of £30 a year, for three years, are offered to the best candidates among the Cambridge Senior girls. Any of these scholarships may be augmented in the case of a student requiring further assistance, but only one scholarship can be held by the same student.

Instruction is given, by correspondence or otherwise, in the subjects of the entrance and scholarship examinations and the other examinations which qualify for admission to the college by students holding the degree certificate of the college.

The great majority of Girton students take honours in a Tripos (the Cambridge Honours Examination), and have open to them the Mathematical, Classical, Moral Sciences, Natural Sciences, Theological, Oriental Languages, Law, Historical, Mediæval and Modern Languages, and Mechanical Sciences Triposes. A degree certificate can also be obtained by passing the University examination for the degree of Bachelor of Music, and a University certificate of proficiency can be obtained by passing the examination on the theory, history, and practice of education. Up to the present year 131 students have taken Mathematical honours, and 146 honours in Classics. Twenty-nine students have obtained honours in the Moral Sciences Tripos, seventy-seven in the Natural Sciences Tripos, fifty-six in the History Tripos, and thirty-four in the Mediæval and Modern Languages Tripos. One student has taken the Theological Tripos, two students Part I. of the Law Tripos, and one the Oriental Languages Tripos. Forty-three students have taken from Girton an Ordinary or Poll degree.

The college course at Girton occupies three years, and the academical year is divided into three terms—the Michaelmas term of nine weeks, beginning in October; the Lent term of eight weeks, beginning in January; and the Easter term, beginning in April, also of eight weeks. The charge for board, lodging, and instruction—£35, paid in advance—covers the whole of the university and college charges. Students who desire to study at Cambridge during the Long Vacation may reside at the college in July and August, at a charge varying in accordance with the number of weeks for which they may wish to stay. Instructions for making application for admission to the college may be obtained from the secretary, Miss Shore Nightingale, 11 Queensborough Terrace, Bayswater.

Newnham College.

Newnham College may be regarded as in part the creation of the North of England Council for Promoting the Higher Education of Women, which was started in 1867, with Mrs. Butler as president and Miss A. J. Clough as secretary. Through the action of this council there were started the Cambridge Higher Local Examinations, which have always been specially recognised by Newnham. It was not till January 1870, however, that, as the result of a meeting in Professor Fawcett's house, courses of lectures were first delivered in Cambridge to about seventy or eighty women. A Cambridge Section Committee was formed, and in October 1871, at the invitation of Professor Sidgwick, Miss Clough originated Newn-

ham in a house in Regent Street. There were then only five Newnham pioneers, all of whom read for honours, and were informally classed. As their numbers increased they moved to Merton Hall, which had taken the place of the old School of Pythagoras. Then in 1875, on land belonging to St. John's, Newnham Hall was built. An increasing number of students came up every year, and this necessitated further building. The North (now Sidgwick) Hall was opened in 1881, and in 1887, when the Clough Hall was completed, the South (or Newnham) Hall became known as Old Hall. Newnham College now consists of three halls, built of red brick, with white stone facings, and stands in about eight and a half acres of land. In October 1893 there was opened the Pfeiffer building, a new wing between Sidgwick and Old Hall, extending at right angles from the back of Old Hall to Sidgwick, with which it is connected by a short covered passage. The main entrance to the college is through an archway in this building, where wrought-iron gates have been placed as a memorial to the first principal of the college, Miss A. J. Clough.

Students who come up to Newnham must be over eighteen, except in individual cases carefully considered by the council. Though the great majority of Newnham students are resident in the three halls, each hall has attached to it a few out-students. They must either reside with their parents or guardians in Cambridge, be over thirty years of age, or be unable to afford the cost of residence in one of the halls, and accustomed to support themselves. Newnham fees for resident students vary with the rooms assigned students. They are from seventy-five to ninety-six guineas a year. Tuition fees for out-students are twenty-two pounds a year. They have the privilege of using the college grounds and library, of joining the various societies and clubs, and of dining in college once a week during term time.

Nearly half of the whole number of Newnham students who have gone down have taken Triposes—informally before 1881, and on the same conditions with regard to residence as men since that time. Some have substituted for the "Little Go"—the first examination of the University—an Honours Certificate in the Cambridge Higher Local Examination, including a pass in Groups B and C. It is advisable to do this before coming up, and so have all one's Cambridge time free for Tripos reading. The examinations are held in June and December. A larger aggregate of work is done when the Higher Local is taken, and the standard is higher than that of the "Little Go," being that of the Poll degree. There is, however, more choice of subjects, and neither Greek nor Latin need be taken.

Tripos students reside from eight to twelve terms, according to the Tripos they are reading for. Higher Local students, or students who are reading for no definite examination, may not reside more than two years without special permission. This can readily be obtained from the council for a third year when students are engaged in work as advanced as that usually done in the third year of preparation for a Tripos. Scholarships are awarded at Newnham chiefly on the Cambridge Senior Local and Cambridge Higher Local Examinations. They are also awarded on the Inter-Collegiate Examinations or "Mays," taken by first, second, and third year students, and exhibitions or loans are offered to students of limited means.

Work for the various Triposes is carried on partly in college and partly out of college. At most of the men's colleges the inter-collegiate lectures given in preparation for Triposes are open to Girton and Newnham students on the payment of fees. Each of the women's colleges has its own staff of lecturers, and their lectures are supplemented by individual coaching. For natural science students there is the Chemical Laboratory, in the Newnham grounds; and the Balfour Laboratory, for biology and physics, near Downing Street, which also belongs to the college. They may also attend the demonstrations given at the Cavendish Laboratory, and work at the new museums.

Newnham has several tennis courts (ash courts and grass courts), two hockey grounds, and fives courts. There is also a cricket club, and nearly every Newnham student rides a bicycle. There are challenge cups for tennis and hockey matches between the different halls. Besides various small college societies, there is a political club, and a college debating society. There is a weekly dance, too, at the Clough Hall, and dancing is resorted to after debates and college concerts.

The first principal of the college, Miss A. J. Clough, was the sister of Arthur Hugh Clough, the poet. "Her life of devotion to the cause to which she gave herself closed amid the reverent admiration of the whole university.....Neither country nor university will ever be unmindful of her whose noble work is now done, and who bequeaths to others the heritage of her gentle power and the memory of the riches of her unerring sympathy." She died in 1892, and was succeeded by the present principal—a sister of Mr. Arthur Balfour. To Mrs. Sidgwick and her husband the foundation of Newnham is largely due. Girton and Newnham and the Oxford Women's Colleges have together a university settlement in Southwark. Old students there work in connection with the Charity Organisation Society, the Children's Country Holiday Association, the Invalid Children's Aid Association, the Metropolitan Association for Befriending Young Servants, and the London Pupil Teachers' Association. Nursing, district-visiting, rent-collecting, and girls' clubs also form part of the work of the settlement.

The Cambridge Training College for Women Secondary Teachers.

The Cambridge Training College for Women was started in 1886, in Crofton Cottages, near Newnham, removed to 12 Queen Anne Terrace in 1888, and removed to its present site in 1893. The present Principal, Miss E. P. Hughes, is an old Newnham student (Moral Sciences and History Triposes), and was previously for four years a mistress at the Cheltenham Ladies' College. She often lectures, and has travelled (inspecting schools) in every country in Europe except Russia. Through ill-health she will shortly be leaving Cambridge, to the great regret of both town and university. Her social meetings for working-men will be very much missed. Besides outside lecturers, there are three resident lecturers and an assistant to the principal.

The course of study at the Training College occupies one year. In September and in January courses begin which include the requirements of the examinations for teachers held respectively in June and December by the University of Cambridge. In January a course commences which also includes the requirements of the London University Examination in the Art, Theory, and History of Teaching. Each course consists of three terms, the former ending in June and the latter in December. In an exceptional case a student may be allowed to reside for a fourth term. The plan of study includes instruction in the Theory of Education, School Hygiene, Psychology, Logic and Ethics, the Art of Teaching, the History of Education, Elocution, Class Singing, Class Drawing, Calisthenics, and Slöjd. In practical work the students practise in two higher-grade schools (700 girls), a national school (240 girls), two private schools (40 and 70 children), the Perse High School (170 girls), a mixed elementary school (90 children), a boys' and girls' preparatory school (30 children), a national school (240 children), two preparatory schools for boys (30 and 40 children), preparatory classes in the Perse Grammar Schools for Boys, three evening continuation schools. Lessons are carefully supervised and criticised. The students have also opportunities of hearing lessons given, and of seeing the complete details of school work and management.

All students live in college, under the care of the principal; but there is a special house for Catholic students, under the care of Miss Donelan. The college fees for the year's course of thirty weeks, including all charges for tuition and residence, are £70. Where two students share a room a reduction of £10 a year is made. No student can be admitted under the age of eighteen, and she must be qualified in accordance with one of the following eight sections:—

"1. By having graduated in some university of the United Kingdom.

"2. By having obtained a Certificate in one of the Higher Local Examinations of the Universities of Oxford or Cambridge.

"3. By having passed the Intermediate Examination in Arts or Science of the University of London or of the Victoria University, or the first University Examination in Arts of the Royal University of Ireland.

"4. By having passed the Examination for Licentiate in Arts at St. Andrews.

"5. By having obtained the Higher Certificate of the Oxford and Cambridge Schools Examination Board.

"6. By having passed the Examination for Matriculation at the University of London in Honours or in the First Division, or the Preliminary Examination of the Victoria University in the First Division.

"7. By having obtained an Honours Certificate in one of the Senior Local Examinations of the Universities of Oxford, Cambridge, or Durham, having satisfied the examiners in English and at least in one other language ancient or modern, and in Euclid and Algebra.

"8. By having been placed in the First Division in the Examination for Certificates conducted by the Education Department, in taking the papers of the second year."

Several scholarships are offered every year, to be held at the college, and there is a Cambridge Training College Loan Fund.

"The Council of the Cambridge Training College offer three scholarships, of £30, £25, and £20, for next September.

"The Gilchrist Trustees offer a scholarship of £25 for next September.

"Candidates must be intending teachers, and must be either graduates of a British university, or have passed a degree examination of the University of Oxford or of Cambridge.

"The members of the Cambridge Training College Guild of old Students offer a scholarship of £20 for next September.

"Candidates must be intending teachers, and of inadequate means, and must be either graduates of a British university, or have passed a degree examination of the University of Oxford or of Cambridge.

"Applications must be made to the Principal before June 24.

"The Council also expend £60 annually in bursaries of £6 and £10 to students of inadequate means.

"Applications must be made to the Principal.

"THE CAMBRIDGE TRAINING COLLEGE LOAN FUND.

"Sums of money (not exceeding £25) are lent to students of inadequate means. No interest is charged, and the money is gradually refunded when the students obtain work.

"Hon. Secretary, Mrs. Meyerstein, 51 Finchley Road, N.W.

"The County and Borough Councils of Cambridge have decided that their Major Scholarships, of the value of £30, can be held for one year at the Cambridge Training College."

Homerton New Training College for Women Teachers in Elementary Schools.

In 1845 the Congregational Board of Education established a college for women at Rotherhithe. Two years later a college for men was founded in Liverpool Street. In 1852 both departments were transferred to Homerton College. This college had previously been "a place of education in connection with the Congregational body," but was now purchased for the purposes of a training college. At the end of the year 1893 the college was removed to Cambridge, and at first there were still both men and women students. In June 1895 the men's department was given up. There are now 144 women students in residence.

The college buildings, which are situated on the Hills Road some distance out of Cambridge, are of red brick, and were originally built as a hostel for undergraduates of about eighteen coming up to Cambridge. When the hostel was dissolved, the Congregational Board of Education acquired the buildings for an undenominational college. "The college was founded by Free Churchmen; it is governed in the spirit of the founders, and is one of the few training institutions where students of all creeds meet on the common ground of a healthy unsectarian religious life."

A small number of the students read for the London Matriculation, but the majority work for the examination conducted by the Education Department. All students are obliged to take one part of this, but a university examination may be taken for the second part.

The latest additions to the college comprise a visitors' room and a students' reading-room. Land has been acquired on which it is proposed to build a practising school near the college. Up to the present the managers of Fitzroy Street British School, the New Street Undenominational School, Russell Street and Union Street Schools, and St. John's Cherry Hinton Infant School, have allowed their schools to be used as practising schools, and the head-teachers of those schools have given their professional help and supervision.

There is a students' literary society; also college clubs, tennis and other outdoor exercise. A very enjoyable reunion of past women students was held at Whitsuntide, and at the close of the year a very successful garden party.

The period of training at the college is usually two years. A fee of £22 is paid on admission. Lodging (except for holidays extending over four days), board, instruction, medical attendance, and laundry are provided. Text-books are purchased by the students.

Application for admission should be made by letter to the Principal, Homerton New College, Cambridge, who will send the forms to be filled up by candidates. There is no other examination than that held by the Education Department; but the Board does not bind itself to admit all or any of the candidates who pass that examination, and reserves to itself the power of rejecting any student at any period of the course if the report as to progress or conduct is unsatisfactory.

Candidates are admitted to the Scholarship Examination, subject to the following conditions:—

1. That they intend, *bonâ fide*, to adopt and follow the profession of teacher in public elementary schools.

2. That having been pupil teachers, they have successfully completed their engagements; or—

3. That not having been pupil teachers, they will be eighteen years of age on or before the 1st of September next following the date of the examination.

Candidates of all denominations are eligible for admission. A very favourable report on the work done by the college was given by Her Majesty's Inspectors in 1898.

Cambridge University Day Training College, Primary Department.

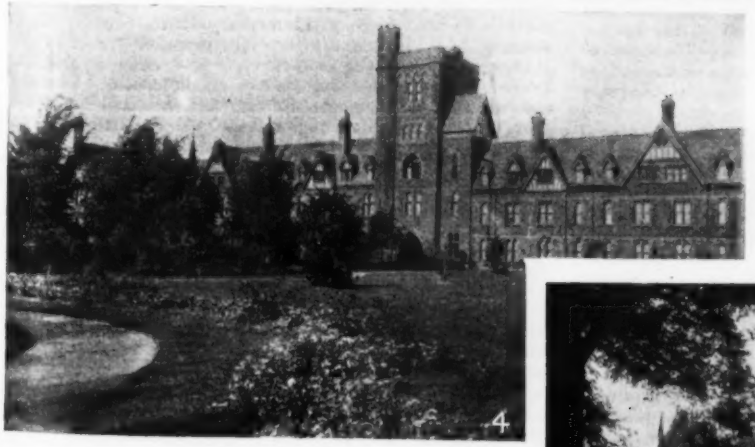
The Cambridge Day Training College, of which Mr. Oscar Browning is the principal, has two departments. The department for training primary teachers is the older; it dates from 1891. The department for training secondary teachers was started in 1897.

When, in 1891, the Cambridge Day Training College was originated by Dr. Sidgwick and Mr. Browning, three objections were made to it:—1. That the students would be "sham university men, living by themselves, not belonging to colleges, and not taking part in the ordinary university pursuits." 2. That the professional education of the students would suffer from the exigencies of university training. 3. That the training given would be adapted not for primary but for secondary schools.

However, in October 1891 the college was opened with three students, two of whom took the ordinary degree, and the third left the college at the end of his second year, and graduated later. One is now a sub-inspector of schools, one is head-master of a pupil teachers' centre, and the third is head-master of a higher-grade school. To satisfy the demands of Part II. of the Certificate Examination, the Day Training College students had, by agreement with the Department, to pass the "Little Go" in their first year, the General in their second year, and a Special in their third year. The students came up knowing no Greek and little Latin, and the principal had to teach elementary classics and history.

In 1892 ten students presented themselves, one of whom had been placed second on the Queen's Scholarship list, while five others were in the first sixty-three. Eight of these students determined to read for honours, and the Department recognised the "Mays" (inter-collegiate examinations in the subjects of the various Triposes) for Part II. in the Second Year. Seven out of the ten students became members of colleges, two gaining second and four third classes in their Triposes, while one was allowed the ordinary degree. On the professional side eight first classes were obtained in the second year certificate examination, and five in the third. A classical tutor was added to the staff. In December 1898 there were twenty-five students in the primary department, and Mr. Browning was able to say, "Our students take good places both in Part I. and Part II. of the Certificate Examination; they belong to colleges, they row in college boats and play in college football teams, and they leave us with a measure of university spirit which will last them through their lives."

COLLEGES AND EDUCATIONAL INSTITUTIONS AT CAMBRIDGE.



1. The Cambridge Training College
2. Newnham. (Miss Hughes).
3. Homerton (Cavendish).
4. Girton.
5. The Leys School.

To the second objection urged against the college, it is replied that its standard in practical teaching has always been high, and the importance of writing, recitation, school management, and the theory and history of education has been kept well in view.

The third objection has proved wholly baseless. Though there is, unfortunately, among some school managers an objection against university-trained students, the primary students of the college are enthusiastic about the routine of elementary teaching. One student who had taken a second class in his Tripos went straight from the college to teach little children of the first standard in a Waterloo Road Board School. He was promoted in 1898 to be principal of an organised science school. They introduce football and other games, and are "elementary teachers to the backbone."

With regard to the expenses of primary students, the cost when a Cambridge college is not joined is from £65 to £75 a year. £25 of this is provided by the grant, as no entrance fees are charged, and about four-fifths of the students have held Toynbee Hall Scholarships of the value of £25 a year each. The remainder of the £65 has to be found by the students themselves. Membership of a Cambridge college will cost £100 a year, and any scholarship offered at such a college merely provides the additional sum required for a collegiate as compared with a non-collegiate life. Mr. J. W. Hiffe, M.A., St. John's College, is the master of method; and the tutor in the theory and history of education is Mr. W. Jenkyn-Jones, B.A., of Gonville and Caius College.

Cambridge University Day Training College, Secondary Department. The Secondary Department of the Cambridge University Day Training College is the outcome of the efforts of the Teachers' Training Syndicate. During the twenty years the syndicate has existed it has held examinations once or twice a year in the theory, history, and practice of education, and has also examined the pupils of certain recognised training colleges and others in their practical skill in teaching. It has granted 1,252 certificates to women and 39 to men,* and it has also provided lectures at Cambridge in the theory, history, and practice of teaching. In 1897 Sir Joshua Fitch drew up a memorandum for the use of the Teachers' Training Syndicate and the Day Training College Committee, in which he pointed out that at several day elementary training colleges—for example, Manchester, Nottingham, Leeds, Cardiff, and Aberystwyth—arrangements had been made for secondary students. The Professor of Education, or Normal master, had given lectures to both classes of students alike; and the professors of mental science, of classics, or of history, had provided for the secondary students such additional instruction as was necessary. He advised that the Cambridge Day Training College should be recognised by the syndicate, on the understanding that the college should make such additional provision as might be necessary for the teaching of advanced subjects.

Mr. Browning, during the Long Vacation of 1897, visited German and Swiss normal colleges, and found that the training of secondary and primary teachers was carried on together up to a certain point, but that the secondary teachers received additional instruction which was not given to the primary students. He found also that the general opinion there was that a joint training should be given at a university.

In January 1897 the secondary department of the college was opened—Mr. A. A. Hall, who had been for twelve years the head of a secondary training college at Madras, taking for a time the superintendence of secondary work. Three students offered themselves—a Master of Arts (Class I., Natural Sciences Tripos, Parts I. and II.), a Bachelor of Arts (Tenth Wrangler), and a Roman Catholic undergraduate reading for the Historical Tripos. The plan of work organised was:—1. Attendance at the lectures on the history of education delivered by Mr. Courthope Bowen on Wednesday and Saturday afternoons. 2. Attendance at the criticism lecture given every week for the benefit of the primary students. 3. Attendance at a criticism lecture given every week to secondary students only. 4. Attendance at lectures on school management (the building of the schoolhouse, the arrangement of the class-room, and the elementary principles of school hygiene). In the first term the students' practical teaching was carried on in the Higher-Grade School, Paradise Street. In the May term weekly excursions were made to Bedford and Haileybury for the purpose of practice, and a Long Vacation course was held for six weeks from Monday, July 4. Lectures were given on "Psychology," "The Practice and History of Education," "The History of Education," and "The Theory of Education." The practical teaching consisted of a number of criticism lessons averaging about three a week, and of teaching in school under supervision. Twelve students out of eighteen presented themselves at an examination, held at the end of the course, in psychology and the theory, history, and practice of education, and all of them passed, eight obtaining more than two-thirds of the whole number of marks.

* To the end of 1898.

II.

The Perse School for Boys. The Perse School for Boys was founded as a Free Grammar School by the will of Stephen Perse, M.D., who died on September 30, 1615; but before this time bequests of a hundred marks each had been made, for the same purpose of contributing towards the erection of a school for the town, by William Bridon, M.A., and Thomas Cropley, M.A., Fellow of Clare Hall, who were therefore really the first benefactors of the school. It was founded for a hundred scholars born in Cambridge, Barnwell, Chesterton, and Trumpington.

In 1841 a scheme was drawn up for the management of the Perse School, which was confirmed by an order of the High Court of Chancery, dated July 31, 1841. This was supported by an altered scheme of the Endowed Schools Commission, sealed March 13, 1891, under which the Rev. Frederick Heppenstall was the first head-master.

Mr. H. C. Barnes Lawrence is the present head-master. The school is divided into a Classical and Commercial department, in accordance with the amended scheme. The former is for boys preparing to enter the university and learned professions, and for those intended for commercial pursuits. The subjects taught are Classics, Mathematics, Science, and English. In connection with this department there is a preparatory form for boys of seven years old and upwards in connection with the Classical Department. The mistress in charge is Miss Adam, from the Cambridge Training College for Women Teachers. The class-rooms and the hours of work and play are kept entirely separate from those of older boys.

In the Commercial Department Greek is not taught, but stress is laid upon the teaching of English subjects, Mathematics, French, German, Elementary Latin, Science, Bookkeeping, and Shorthand. Boys are prepared for the Cambridge Local, the Government Art and Science, and the lower branches of the Civil Service Examinations. There is also an organised Science Department. School hours are from 9 to 12 in the morning, and 2 to 4 in the afternoon; on half-holidays from 9 to 12.45. Home work, averaging about two hours in duration, is also required from each boy. There is a half-holiday every Tuesday, Thursday, and Saturday.

By the regulations of the new scheme, twenty-five boys at least, born in Cambridge or the parishes adjoining—Grantchester, Barnwell, Chesterton, or Trumpington—are to be educated as foundationers, and as such are to be exempted from payment of all entrance and tuition fees. Of such boys, those shall be first preferred who have been for one year at least educated in the public elementary schools of those places; but in default of fit candidates from among such boys, the exhibitions shall be thrown open for competition among all scholars who shall have belonged to the school during twelve months immediately previous to the examination for such exhibition.

Trinity College, Cambridge, has recently endowed certain scholarships, which are tenable in either department. The fees for the Commercial Department for boys under thirteen years of age are £2 per term; over thirteen years of age, £2, 13s. 4d. per term. In the Classical Department the fees are £5, 6s. 8d.

The records of the school honours prior to 1866 seem to have been lost or destroyed; but since that date the dis-

tinctions obtained at the universities include seven fellowships, four university scholarships and prizes, eighty-six open scholarships and exhibitions, thirty-one sizarships, and three Goldsmiths' exhibitions. The school has had twelve wranglers (including the senior wrangler), a Smith's prizeman, eight senior and nine junior optimes. In classics and other subjects there have been twelve first classes (including the senior in the Law and Moral Sciences Triposes), thirty second, and twenty-eight third classes.

In the Cambridge Local Examinations there have been since 1884 three first classes (including the highest place), six second, and three third classes, with fourteen distinctions and four passes among the senior candidates. In the Junior Local Examinations there have been six first, nine second, and twelve third classes, with nineteen distinctions and twenty-nine passes. In the Art and Science Examinations there have been placed, since 1886, 117 in the first class, with 234 passes.

The Perse High School for Girls. Under the new scheme an endowment of £150 a year had to go to found a High School for Girls. Owing to the depression in the value of land, the endowment is now under £30 a year. For starting the school, £500 was raised in addition. In 1880 a committee was formed, under the presidency of the late Master of St. John's College. The endeavours of this committee were so successful that the school was begun in January 1881, at 68 Trumpington Street. During the first term it had twenty-eight scholars, and in December of that year it had grown to sixty-five, and was examined under the Cambridge Syndicate, receiving a favourable report. In 1882 the house in Trumpington Street proved too small for the growing numbers, and the Kindergarten had to be transferred to a house close by. In March 1893 the school was removed to Panton Street. In 1889 a large iron room was added to the school, and in 1897 a new wing, affording a fine kindergarten room and two large class-rooms for over fifty girls. In 1898 the school acquired a large hockey ground.

From the foundation the head-mistress has been Miss Street. The school fees for day girls are three or four guineas per term, or five pounds per term; in the Kindergarten, two or three pounds per term. Private lessons are given in pianoforte and violin; singing, harmony, advanced drawing, painting, dancing, Swedish calisthenics, and Slöjd are extras. Boarders are received in the head-mistress's house, and in two other houses.

No girl is admitted to the school under seven years, or allowed to remain in the school beyond the end of the school term in which she is nineteen. Boys and girls are admitted to the Kindergarten at the age of three years, and are allowed to remain in the transition class till the age of eight or nine years by special permission. Two scholarships of the value of £15 per annum are from time to time awarded by Trinity College, for girls who are between eight and eleven years of age on the day of examination, and have passed the fourth standard of the Education Code (1885) in a public elementary school in Cambridge, Trumpington, Grantchester, Coton, Cherryhinton, Fen Ditton, Chesterton, or any other place the schoolhouse of which is situated within a radius of two miles and a half from Great St. Mary's Church.

The number of pupils now in the school is 190. The examinations taken have been the Cambridge Local Examinations from the beginning, the head girls taking groups in the Higher Local. The whole school was examined by the Cambridge Syndicate up to 1897, but in 1898 by the Oxford and Cambridge Joint Board.

The Leys School. The Leys School was opened with sixteen boys on February 16, 1875, "for the purpose of affording an opportunity of a high-class public school education under religious auspices and influence, but free from the special ecclesiastical bias of most of the older public schools." Cambridge was chosen, partly because of the neighbourhood of the University, partly because of the admirable site that offered itself for the school. It was formally inaugurated on March 11, and was incorporated (under the Charitable Trustees Incorporation Act, 1872) on July 16, 1878.

The school buildings stand in twenty-one acres of ground. In 1875 the schoolhouse was completed by adding the wing which contains Dormitories 3 and 4. In 1878 the west house was put into use, and in 1880 and 1883 respectively the houses in the north block A and B. Between 1885 and 1890 the school acquired a farm for the supply of fresh vegetables, milk, etc., an excellent laundry, a new water supply, and a new and well-appointed sanatorium. In 1891 a new wing was added to the schoolhouse, thus giving the school a covered playground, three good class-rooms, and a dining-room. The hall is used as a chapel for daily prayers and Sunday services, for a general assembly room for prize-giving, and for concerts and lectures. In 1895, No. 1 dormitory, which had been connected with the sick-room, was divided into separate rooms and equipped as an infirmary.

The first head-master of the Leys was Dr. Moulton, chiefly known away from Cambridge by his share in the revision of the New Testament and his editorship of *Winer's Grammar of the Greek Testament*. A gold medallist, prizeman, and examiner of the University of London, from the first he made the Leys a thoroughly modern school. Modern languages, with foreign correspondence, a drawing school, workshops both for metal and wood work, music, the Kelvin science laboratories for chemistry, biology, and physics, have brought the school into the front rank of modern public schools. The present head-master, the Rev. W. T. A. Barber, M.A., organised the Wesleyan College at Hankow.

The Leys has always been good at games. Every boy is required to learn swimming, to practise in the gymnasium, and to join in the games, unless some special reason for exemption exists. In lacrosse, the South of England challenge flags have been twice won by the school team—in 1885 and 1888—and the junior South flags by the second team in 1892. The latter also won the junior South cup in 1894. As their school song says,—

> "We are the Knights of the Crosse,
> The fast-flying ball we toss
> Over the green, the posts between:
> Hurrah for the Knights of the Crosse."

The Leys Bicycle Club was founded in 1882, and in 1884 there were instituted the annual race meetings on the eve of Speech Day, for a challenge cup. The Games Committee controls the school games, and the grounds, courts, funds, prizes, etc., connected with them. Under its auspices the running path, football ground, and most of the cricket ground have been laid, the fives courts roofed, and the pavilion built. In sixty-five successive matches at football, forty-one of which were with colleges of the university, the Leys boys beat. The Old Leysian fifteen has beaten every London team they have met, and on four occasions the university team.

The Leysian Mission was started by Old Leysians in Whitecross Street in 1885, and soon a medical mission, a club for working-men, classes for boys, a Sunday school, and week-night entertainments became part of it. The first resident missioner was appointed in June 1888. In 1890 the present premises in Errol Street were opened, and the present missioner is helped by about seventy mission workers. Moulton House, a home for boys and men, in President Street, is an outcome of the Leysian Mission.

The Leys Natural History and Science Society was started in 1878. Prizes are offered every year for the best collection (1) of pressed plants, (2) of moths and butterflies, (3) of original photographs. The School Museum is in the new science block. The Leys Literary and Debating Society was formed in the first term of the school's existence. The Leys Orchestral Society, started by Dr. Carr, has given May-term concerts since 1880. The Old Leysian Union was formed in 1882. There are an annual Old Leysian dinner and an annual conversazione.

Several entrance scholarships, of from £20 to £50 a year, tenable at the school, are offered for competition every year. The school fees vary from 80 to 100 guineas a year. The Leys list of honours, for the size of the school and the few years it has been established, is good. Four fellowships, as well as many scholarships, have been won at various Cambridge colleges; also several university distinctions, such as the Members' Latin and English prizes, the Whewell and Lightfoot Scholarships, and the Chancellor's English medal. In one year seven of those who entered the University direct from the school obtained honours—three in classics, three in

law, and one in natural science. Two of these were placed in the first class of the Classical Tripos. Four entrance exhibitions have recently been won in history at King's and Caius Colleges, and there have been four Old Leysians holding major scholarships at Trinity College simultaneously. First-class honours have been won in natural science and mathematics (sixth wrangler), besides scholarships at various colleges in three subjects in 1896. At the University of London, the classical scholarship at the B.A. examination and the gold medal in classics at the M.A. examination have also been gained. The B.Sc. and B.A. degrees have in several instances been taken by boys still at the school. At Oxford, the Stanhope (University) History Prize has been won.

The school motto is, *In fide fiducia*.

THREE GREAT SPANIARDS.

II.—LOPE DE VEGA.

EVERY country of long standing may be said to have in its firmament of genius two bright particular stars—one that is its own pole-star, and one that is such to other countries. To the outside world Cervantes is the pole-star of Spain, from which the distance of all others may be measured; but the Spaniards themselves are inclined to give this pre-eminence rather to Lope de Vega. And for this reason: he it was who, finding the drama of his country in a most chaotic state, made it his life-work to reorganise and to give to it definite form, to create the three-act-comedy, and also to create in the dull but theatre-loving public of his time the power to keep up their interest in a piece of three parts to the end. And in this he succeeded, and made the Spanish theatre of to-day what it is. For all this, Spain feels it owes to Lope something of the gratitude we pay to our greater giant Shakespeare; and, curiously, just as Cervantes is comparable in degree with Shakespeare in humour, so, in a way, is Lope de Vega in dramatic power. But is not Shakespeare the searchlight by which we can see the depth of genius in all geniuses? The Spanish dramatist, however, as a man and as an author, will never share that warm corner of our hearts so long occupied by the gentler humorist, the time-honoured Cervantes.

Lope de Vega del Carpio was born, November 25, 1562, in the jewellers' quarter of Madrid, of parents who claimed descent from some of the lesser nobility of the province of Asturias, where to this day a little hamlet of Vega still exists. His early studies were made at the Imperial College, the chief establishment of the Jesuits in the capital. There his wonderful memory and his general precocity soon amazed his tutors, who drilled him well in grammar and in rhetoric, not omitting the smaller matters of fencing, dancing, and singing—the Jesuits aiming above all things at making their pupils men of the world. This particular pupil must have been much to their taste, for at five years of age he spun out verse so easily that, unable as yet to write it down, he bribed his school-fellows, by the gift of his dinner, to record it as it flowed from his lips; and not very far advanced was he in his teens when some escapade led to his removal from the college. We next find him in the retinue of the Bishop of Avila, occupying a post involving no loss of position, but simply supplying to a young man of his class the only means then open of seeing the world. This was a custom not confined to Spain: in our own country the mansions of the nobility often numbered among their dwellers young gentlemen, and often young ladies, who learned the *grand air* of *haut ton* as they could not in their more rural homes—the establishment of their patrons thus representing in a small way the court life of royalty. In Wales, at least, this system continued to the end of the seventeenth century. To the hidalgos of Spain, who mortally hated trade, nothing better than this could unite the pride that went with ambition for their children's success. In this manner, as page or secretary, Lope had had some training when he was entered at the university of Alcala, where he spent the next four years of his life in the study of philosophy and of the ancient writers, and in learning that sparring literary style so dear in those days to the disputants of the various schools of thought. To this period some of his critics ascribe the foundation of the overweighted style of some of his writings. Before leaving Alcala he took the B.A. degree, and shortly after became secretary to the Duke of Alva.

In 1584, when twenty-two years of age, Lope married Isabel de Urbino, the daughter of a herald-at-arms of Philip the Second. Of his domestic life a somewhat long tale might be told, because of its vicissitudes; but as we are dealing with our subject rather as a *littérateur* than as a man, suffice it to say that shortly after the marriage, the young husband having lampooned somebody who had, he thought, spoken unjustly of him, challenged the offender to a duel, and wounded him. The law stepped in, and Lope, failing to set himself right in its eyes, was advised to take flight to Valencia. There a very different state of things awaited him: a band of enthusiastic young poets gave him a most romantic reception as the creator of the new comedy—all the more emphatic, doubtless, because of the mist of romance which in young men's eyes, naturally enough, clung round the refugee of the duelling episode. A very good time altogether he had in Valencia for at least two years, when it seemed safe to return to his wife in Madrid. But further trouble was in store: the young wife in 1588 died at the birth of a daughter, who also died. It was this double loss that connected—slight though the connection is—the life of Lope with the history of our country. Disconsolate in his widowerhood, our young poet sought relief in joining the Armada, which was then setting out to swoop down on our shores. So, while Cervantes was scouring Spain for supplies for the great fleet, Lope was volunteering active service in it. And not he alone of his family: two of his brothers also joined, and all fought together till a shot from an English vessel struck one, who fell dead by Lope's side. Happily for literature the poet-soldier escaped, and returning to Madrid when the expedition had failed, he again took service in a great man's suite. Time went on and on, and once again he thought of marriage—this time with a Madrileña. In domestic life fate again dogged his steps (and may this not partially account for some lapses of conduct which, later on, are to be deplored?), and the second wife died at the birth of her second child in 1612, and was laid to rest with her infant, as the first had been. There was no Armada now to distract sad thought; and had there been, Lope, who was fifty years of age, had doubtless lost the fire and energy of youth which were his in that great naval battle. But there was then, and always, that constant refuge of the disappointed and the weary—the church; and Lope turned to it. His contemporaries said it was for a peaceful retirement and an assured livelihood, the only escape from the world which now lay at his feet, and to which he was a veritable pope, as much or more to Spain than Voltaire was to France more than a century later. But how could such a man for long keep in a frame of mind suitable to one belonging to an order of priests, even though that order were only an allied or tertiary order? Let us imagine for a moment our Shelley, or Burns, or Byron attached to any religious fraternity whatever—more especially Burns, who with his orthodoxy and his moral slips is the nearer parallel. To be sure, these three had burned themselves out long before reaching the age of Lope when he turned priest; but would a decade or so added to either of them have toned them down to the proper temperature for making good sons of the church—of any church? Certainly poor Lope was no ornament to his profession, for a *liaison* with a married lady well known in Madrilean society did not add to his reputation, although it was not the scandal it would be now either in Spain or elsewhere. "Other times, other manners;" and it would be unwise to judge the past by the rules of present conduct. Those who see most changes in the light of the evolution theory, and regard all the past as necessary links in the chain which attaches it to the present, are not overwhelmingly astonished as they read of the public sanction which the great patron of Lope gave to this alliance, nor are they greatly surprised that the church practically condoned it. But to the people

of that day, who believed the church to be a divinely-guided agency, it must have been at least a little perplexing; and we can understand how this and similar conduct, oft repeated, led to scepticism in some countries, and to puritanism in others.

Before leaving this very personal side of our subject, we may perhaps be allowed to allude to a later folly, which occurred in quite advanced age, and is chiefly of psychological interest, as it shows how the versatility of genius often runs wild, and seems ready to topple over into something like irresponsibility. The longer we dwell on the lives of great men in connection with their very little follies, the more inclined we are to say with M. Necker, "*Dieu sera clément au génie.*" For the sake of our own erratic trio, as well as for Lope de Vega, this is devoutly to be wished. How unstable he was, how like poor Burns, always failing and always repenting, the readers of his biography cannot forget. The self-inflicted Friday flagellations, when the floor of his cell was besprinkled with blood, are not pleasant reading, although we may fairly infer therefrom that however high a man may soar in intellect above his contemporaries, he is seldom, if ever, quite clear of the spirit of his age. The physical penances of the great Spanish poet were quite impossible, before two centuries were gone, to the equally repentant poet of Scotland.

Great as Lope is to us to-day as a poet, he was that and much more in his own time. The highest aristocracy in haughty Spain were proud to be his equals; even the Pope, Urban the Second, in 1627 did him the honour of offering the diploma of D.D., with the cross of the Order of St. John of Jerusalem. In home life he was gentle and affable, loving much to tend his plants. He never thought himself beyond criticism, and, as a rule, was extravagant in his praises of others. Perhaps the most notable exception to this were his hard words about Cervantes; but these, his biographer says, were in a letter to a friend. In 1619 he wrote in another letter thus: "With some garden flowers, half a dozen pictures, and a few books, I live without envy, without desire, without fear, and without hope."

At last the day came when this stormy life of studious seclusion, of battle-fray, of passion and of penance, of strange mobility and of all eccentricity, was withdrawn from the world; and all Spain mourned the withdrawal. The whole nation stopped its usual occupations to follow to the tomb, on August 27, 1635, its greatest dramatist. The Duke of Lesa was chief mourner, then came the *literati* of the land and the nobility, and in the streets the crowds gathered to do the last honours to the man who had made drama as intelligible to them as to the scholars. His memory was embalmed in many a sonnet and funeral oration, but he would have been without their aid what he remains—the greatest dramatist Spain has produced.

His Work.

So far we have spoken of the man. Let us now consider, as well as we can in the limits of a paper like the present, the character of his work. The latter, of course, was influenced by his tastes, and rather unusually so, for it is said his love of flowers supplied many of his metaphors, and tended to too great elaborateness. His contemporary readers possibly approved of the latter—it was their own special weakness; but they were not flower-lovers as a nation, and valued less his allusions to Flora. A great point in the character of our author was common sense: he had the wisdom to see even in that age that a writer should make himself understood, to which end he used the ordinary vernacular, the pure Castilian of his day, which is now almost what it then was. Mannerism was a great defect with his contemporaries, and although Lope de Vega had not the courage to quite discard the popular style, he was freer than most from it. To be sure, he had his prejudices, like other great men; the chief one was, that Latin is far superior to Greek. To his son Lope Felix del Carpio he wrote: "So you have begun to grapple with the rudiments. It is one of the things that cannot be avoided; but, for all that, if I could find some one to teach you your own language well, I should be quite satisfied: for I have seen too many of those who, having learned Latin, are ignorant of their native tongue, and affect to despise everything written in the vulgar idiom. What presumption to forget that the Greeks did not write in Latin or the Latins in Greek! I confess I laugh whenever I see men giving themselves out for Latin poets who write in their own language like mere barbarians; and I conclude that they cannot possibly have been born poets, for the true poet (there is not more than one, they say, in a generation) writes in his own language, and it is therein he shows his excellence. Nevertheless, I do not wish to discourage you from learning that queen of languages (Latin), the third in the world in point of antiquity. Try to know it as well as you can, my son; but by no means learn Greek, for I would not have you like those who strut and give themselves airs because they acquired a smattering of it." If the reader has not here enough to justify the biographer's statement that common sense was an essential gift of the poet's, let him con the next quotation: "Have but few books, and these choose with care: diligently observe the thoughts they contain, and do not let anything noteworthy pass without a note in the margin.....The less of verse you make the more you will be esteemed and appreciated. You need only take example by me. See what my diligence has brought me—to the smallest of houses, a narrow bed, a poor table, and a patch of garden, the flowers of which expel my cares and supply me with ideas." By way of parenthesis it may be said that tulip-fancying also supplied him with a friend, to whom, in gratitude for precious bulbs sent from Flanders, he dedicated one of his works. But of general culture Lope had great store. After Latin, Italian was his favourite language, and Ariosto and Tasso his best-loved poets; then came French literature. "Ignorant laymen" he was apt to call those who were not well skilled in Latin, and seemed to feel himself superior to Cervantes, who had not had a university education.

In 1776 twenty-one volumes of his non-dramatic works were collected, under the title of *Obras Sueltas*, and published at Madrid. The chief of these is *The Arcadia* (1598), a pastoral romance, written at the instigation of the Duke of Alva, and inspired by Cervantes' publications; this is said to be one of the feeblest and most tedious. *Isidro* (1599), a narrative of events in his patron's life, is not of general interest. But to us the *La Dragontea* is highly pleasing. It deals in fantastic form with the last adventures and the death of our hero Sir Francis Drake, who was to the Spain of that day a terror so great to both fleets and coasts that his name was only another and an interchangeable one with his satanic majesty's. This, apart from its literary composition, must ever interest the fellow-countrymen of the greatest sailor of the greatest period of English naval history. Many more were written, and then it occurred to Lope to try his pen against Cervantes. This he did in imitating *The Examples* of that great master; but signal failure followed. The ease, and grace, and originality of the author of *Don Quixote* were not his, and this attempt must be reckoned a failure. In 1630 he wrote his last poetical narrative, entitled *Laurel de Apolo*. This, too, is in fantastic form, and represents the Spanish poets crowned by Apollo on Mount Helicon. But as a poem this is less valuable than as a catalogue in which the student of history is able to read the names of many of Lope's patrons—a trick in the trade of the patronised poet in those days, when patronage of learning and the arts was universal. Of all the contents of the twenty-one volumes of non-dramatic works it is said the *Dorotea* is the most choice and beautiful, and most likely to live.

But the *dramatic* works of our author are those which have placed him in the first ranks of genius. It was his aim to create such dramas as would retain the interest of the spectators through three acts, and this was accomplished. But his writings as a whole were hurried, and consequently too numerous—too numerous to have the vital force which ensures immortality. Of more than a hundred of the comedies their author writes: "They have taken only twenty-four hours to pass from my brain to the boards of the theatre." Montalban says Lope, when in Toledo, copied fifteen acts in fifteen days. On one occasion he and his biographer divided the acts of a comedy between them, and each wrote against time. In two days two were finished; the third was finished by

Montalban, who rose at two in the morning, and completed it by eleven. He went off to Lope, who said, "I rose at five, finished the act, breakfasted, wrote an epistle, watered the garden; and a rather tough business it has been." The critic says of such work, "This is not art but handicraft," and better suited to spectators from the crowd than to students. Later in life Lope was severe on himself, and was of opinion that his *Jerusalem Conquered* and his piece on Drake would outlive his more hurried work. He gauged the verdict of posterity very clearly, saying in his literary last will and testament, "It is to me that the art (of comedy) owes its beginning, although I have departed from the strictures of Terence. It is I who gave the example which is followed and copied on all hands."

To judge of the variety and rapidity of the dramatist's mode of writing, we may quote the number of his productions and the dates of their appearance. Up to A.D. 1604 two hundred and thirty comedies had been given to the world; by the year 1609, only five years later, five hundred had been written; and before the year 1632 was ended a total of fifteen hundred had been reached. Lope now had only three years of life left, but in that time he added to the number three hundred more. In the library at Madrid a catalogue of all may be seen, but only six hundred and eight are extant. To create this enormous array of literature Lope put under contribution some Italian history and romance, but his inspirations were chiefly drawn from the history of his own country, and from the events taking place daily under his eyes. It was an age of intrigue, and consequently intrigue is the chief feature his genius represented. The age was also one of popular ignorance; the mass gained their knowledge of current events from the stage much more than from books. Their patriotism was aroused by scenes enacted in a theatre which represented national victory; their personal sentiments were fed by the presentation of *affaires de cœur* and *affaires d'honneur*. Thus it came about that the works of Lope most freely translated in Europe were chiefly those which portrayed these specialties. The *morale* of a piece was often to be obtained from the living examples incorporated *nolens volens* into the comedy.

To sum up what our author did for Spain, and through Spain, in a secondary sense, for the world, it may be said he changed the face of the drama of his time by introducing within its narrow limits fresh situations, some from the Bible, some from mythology, and some from a very nearly allied source to the latter, the lives of the saints: history and legend, Italian romance, and the current life of his countrymen, all paid tribute. His own estimate of his work comes very near that of most of his critics. He gave to his country a means of instruction and edification not theirs, except rudimentally, before his time; and those of like genius who came after him have had only to follow in his steps. One pupil specially—Calderon, who is to be the subject of our next and final paper—is immensely indebted to his great master, and continued during the remainder of the century to wear with distinction the mantle of Lope.

Much more, of course, might have been written of the great Spanish luminary than a short paper like the present allows, but all who wish for fuller information will be amply repaid by the perusal of Montalban's *Life of Lope de Vega*.

J. M. D.

A GREAT FRENCH EDUCATIONIST:

PÈRE DIDON.

BY CLOUDESLEY BRERETON, M.A., L. ÈS L. (PARIS).

EDUCATIONISTS in France are, as in England, divided into two parties—those who believe in State control, and those who consider that education should remain a matter of private and religious initiative. In England, however, the line of cleavage is far from distinct, and the moderates of either party are on speaking and even friendly terms with one another. In France the partition line is clear and well defined, and the two parties are not merely rivals, but often adversaries. Any one, however, who has seen both types of education in France will find there is good in both, as far as the development of the intellectual side of the pupil is concerned. The weak side is the building up and development of character, and in this respect the man who has seen the farthest and most clearly is the celebrated Père Didon, who is at the head of the two large secondary schools of Arcueil and Lacordaire. Any one well acquainted with French pupils will readily admit that the students who come from these schools are far more like the average English schoolboy than the ordinary *élève* of the French *lycées* and *collèges*. But Père Didon is not merely content with the reforms in school government he has introduced into his own establishment; he has lately been spending three weeks in England, in order to study our public school methods of education on the spot. He certainly has not let the grass grow under his feet during his stay here. He has seen, under competent guidance, Winchester (perhaps the most archaic in type of our public schools), Eton, and Harrow. He has paid flying visits to the two universities, seen three or four private schools, one or two London schools, made an excursion to Edinburgh to see its schools and university, calling on the way there at Rugby, and on

the way back at Birmingham. He has even found time to visit a couple of our London Board schools, a pupil teachers' school, and a teachers' training college.

His general impressions seem to have been excellent. He admired greatly the art of self-government as taught in our public schools by and through the games. He recognised that as the sentiment of freedom can only be developed by granting to the pupil an ever-growing latitude of liberty, so the art of self-government and the government of others, so essential to a race of empire-builders such as we, must proceed on the same lines, and must begin early. He remarked it began indeed in the preparatory schools. His object in visiting the universities was not so much to see the buildings or inquire into the course of studies pursued, but to see the finished article, as it were, that they turn out. In his passionate love of studying life and the living thing, and his contempt for the mere husk of system, Père Didon often recalls Thring. He has the same conviction of the need of finding the right surroundings and situations for a school, as, after the personality of the teacher, the position of the school and its site is one of prime importance. In Eton and Harrow he found sites that realised all that he hopes one day to develop in France. The question of mere instruction interested him less, but he rightly divined that the three main English problems to-day are the questions of State control, of modernising the curricula in a scientific direction, and the position of Latin in the curricula. It is rare to encounter any one who observes so justly and with less *parti pris*. He had come to England with a prejudice against gymnastics, derived from the acrobatic fashion in which they are studied in Germany, but was quite won over to them from what he saw at Edinburgh, Birmingham, and at the Stockwell Pupil Teachers' School.

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A SPECIAL OFFER TO PRACTICAL TEACHERS.

IN the most famous list of the hundred best books the first place, as a matter of course, is given to the Bible. In the vast majority of the popular schools of our land an essential part of the daily work consists in reading and explaining selections from the various books of the Bible.

To the task of elucidating every difficulty in these ancient writings have been directed the untiring efforts of the most eminent scholars, the most patient investigators; and the results have been embodied in innumerable works for the guidance of teachers, preachers, and students.

Now, for the teacher preparing a lesson, as for the student pursuing any special study, it is important, if possible, that he should not have to lose time in seeking information scattered through so many different books. Accordingly, publishers of Bibles have bound up copies of the Bible text with appendices of aids to students and teachers; and the purpose of this article is to call attention to the latest of these combined works, which has, we think, strong claims to be called *the* **Teachers' Bible.** This work, published by Messrs. Thomas Nelson and Sons, consists of the Authorised Version of the Holy Bible, followed by Nelson's *Illustrated Bible Treasury.*

The books of the Old and New Testaments are beautifully printed in minion type on double-columned pages, with a narrow central column for the ordinary marginal references. The Old Testament occupies 802 pages, and the New Testament 245.

It is, however, the Bible Treasury which constitutes the remarkable and distinctive feature of the volume. This work has been produced, under the general editorship of Dr. William Wright, by the co-operation of some forty contributors, nearly all of whom are of the highest repute as experts in special departments of Biblical scholarship. Professor James Robertson writes sections on the Title of the Bible, the Canon of the Old Testament, and its transmission; Professor Sayce contributes articles on Monumental Testimony, and the Nations of the Bible; Lieut.-Col. Conder treats of the Topography of Bible Lands, and General Sir Charles Wilson of the Travels of St. Paul. Introductions to the various books of the Old Testament are supplied by Drs. J. Robertson, A. B. Davidson, Sinclair, M'Curdy, and others; and to those of the New Testament, by Drs. Riddle, Ramsay, Marcus Dods, and Talbot Chambers. Such subjects as Geology, Astronomy, Natural History, and Antiquities are dealt with separately by Professor Bonney, Mr. E. W. Maunder, Canon Tristram, Dr. Gunther, and other specialists. This list might be greatly extended.

The various subjects are presented in the best possible form, and are extremely well arranged and fully indexed, so as to facilitate reference.

A further useful and attractive feature are the illustrations, which number about 350, and include views of Bible scenes, reproductions of monuments, coins, implements, and other interesting objects, as well as admirable figures of animals and plants.

The Bible Treasury is followed by a valuable Combined Concordance, with a Dictionary of Proper Names and Subject-Index. In this are indicated all the important variations in the Revised Version. Lastly, we have a series of Maps of Bible Lands carefully drawn and coloured, and accompanied by a full Index of Places marked.

The whole work forms a truly marvellous cyclopædia of Bible knowledge, from which nothing desirable appears to have been omitted. Since the total number of pages is fully 1800, the volume might be expected to be rather cumbersome; but quite the reverse is the case.

To make the book the more serviceable, it is substantially bound in full morocco limp, the corners of the leaves as well as those of the covers are rounded, and the edges of the former are red under gilt.

We have examined other Teachers' Bibles, but we feel justified in saying that for comprehensiveness and completeness of contents, for convenience of form and size, and for perfect finish of material production, the one now before us is unmatched by any of its predecessors. The publishers issue a great variety of editions—some much more expensive—but this particular edition, on account of its serviceable character, seems to us best adapted for a teacher's regular use. In our opinion, indeed, it deserves to be regarded as **The Practical Teacher's Bible** *par excellence.*

This brings us to the special point and purpose of this short paper, which is, to make an announcement for the benefit of our readers. The work we have just described is worth half a guinea. But in order to place it within easy reach of every one of our subscribers, the proprietors of THE PRACTICAL TEACHER have made arrangements by which any purchaser of this journal may obtain a copy of

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CONFERENCES WITH PRACTICAL TEACHERS.

BY AN INSPECTOR OF SCHOOLS.

V.—THE CLASS SUBJECTS.

THE class subjects taught in our schools are generally Elementary Science, English, Geography, and History. Needlework, of course, takes the place of one of these subjects in girls' schools; and as we fear the criticism of the ladies in their special work, we shall not venture to make remarks on a delicate subject of this kind.

The choice of class subjects is not always made judiciously. Those subjects only should be taken in which the teachers themselves are proficient, and unless there is a plentiful supply of apparatus, Elementary Science should be left alone.

Object Lessons are now continued in the lower standards of the upper departments, and a few critical remarks on the teaching of these lessons will probably be of good service. In the first place, these lessons should be well prepared, and the note-books of the teachers should show greater care than many of them do at present. Pupil teachers should draw up careful notes of lessons, and they should be encouraged to make sketches of the objects taken. "Arrest the eyes by a diagram," as one educationist observed, "and the ears will stand erect for explanation." A good drawing or diagram is half the work of an object lesson, and nothing rivets the attention of the children so much. Even older teachers should produce careful teaching notes, and indicate therein the *how* of the teaching; and it is also useful for them to state whether, and in what way, the object lessons are associated with other subjects.

In questioning the children, the teacher's voice should be pitched in a quiet, natural key, and individual, not simultaneous, answering should be encouraged. As the children stand to give their answers, or when showing their hands, they should not be allowed to shuffle their feet beneath the benches.

It often happens that apparently wrong answers are dismissed by the teachers very summarily—answers which, on a little reflection, are intelligent. We may depend upon it that a bright child, or even a dull one, who answers when the rest of the class are silent, has some thought in his or her mind worthy of consideration. One of the writer's colleagues on one occasion asked the children of a reading class to explain the word *martyr*. One boy replied, "A martyr is a water-cart." This answer naturally caused some consternation; but the official patiently inquired further from the boy, who explained that he meant "St. George the Martyr's water-cart." Some *association of ideas* came to the boy's rescue, and the lad was duly commended for his intelligence, while his ignorance was dispelled.

Various similar incidents of this kind could be given if space permitted, but sufficient has been said to guard teachers against the habit of reproaching children who *try*. Indeed, a very good mark is often assigned to a teacher who can deal skilfully with incidental matter in oral teaching.

As regards the teaching of Geography and History, these subjects are of little value unless associated. The notes kept for service should reflect some of the teacher's mind, and should not be simply dry outlines of a syllabus. The teaching of Geography is frequently made very interesting by encouraging the children to bring pictures of various kinds, which are either hung up round the class or kept in a scrap album, and some teachers who make holiday tours in the British Islands or on the Continent bring back with them views, which they describe to the children. In boys' schools the teachers show considerable power in drawing maps on the blackboards, and these are filled in skilfully under the eyes of the children. The girls' teachers, however, appear to be more diffident of their ability, and when Geography is attempted by them the teaching is often very mechanical.

History is generally meagrely taught, and the defects arise from the fact that the teachers have not read enough themselves. The matter contained in the Reading Books is not sufficient for good teaching, though it may be ample as a summary of what has been taught. The teachers themselves should read good, big books on History, and thus make themselves at home with the subject-matter of the lessons. Study of this kind will enlarge the mind and enable the teacher to do justice to such a difficult subject. It is only a thoughtful and well-read man or woman who ought to be allowed to give instruction in a study that requires much philosophical treatment.

We have been told that the following question was set with a view to eliciting the thoroughness of the teaching of History; and whether the story is true or not, the suggestion of such a question will illustrate our arguments.

When some candidates were asked to write all they knew of Alfred the Great, *omitting the story of the cakes*, they failed utterly to produce any knowledge of the life and work of one of England's greatest kings. If teachers read well and wisely in preparation for their dealing with Geography or History, they will be able to step aside from the beaten tracks of commonplace knowledge. "Reading maketh a full man," as Lord Bacon has put it, and fullness of knowledge is the key-note of success in the treatment of class and specific subjects.

With regard to the latter, they should not be attempted unless every facility exists in the school in the matter of adequate and competent staff and appliances. "*Do a little well*," is an excellent motto for all schools. If specific subjects are taken, the children should make notes of every lesson, and objects, specimens, and sketches should be freely produced by the teachers and the children when the subjects chosen admit of this treatment.

What may be called *omnibus* schemes have been drawn up for class work by many teachers who feel the desirability of teaching girls Geography and Grammar, and other subjects which they consider should form part of a child's education. As there is a tendency to drop the study of Geography and English for simpler subjects, these general schemes are very useful; but great care should be taken not to overcrowd such schemes, for a certain amount of repetition is necessary, and this cannot be done if too much is attempted. It must be remembered that, while the acquisition of knowledge is a part of learning, the education or training of the children is, after all, of greater consequence.

Related to the class subjects of a school, though not considered as such, are Recitation and Music, and a few remarks on these lighter employments of the children will not be out of place in this paper.

One is constantly being asked to assist in the selection of poetry suitable for Recitation. This should not be the case, as teachers themselves should be sufficiently well read to make their own choice. Of course, the prescribed number of lines appears to restrict the selection; but why should we not learn *part* of a good poem and know the matter of the remaining part? or why should we not make up a deficiency in the actual number of lines by additions from other poems? If this were done, the selections would be better than they are at present.

There are plenty of good poems published, and volumes of particular poems are not now expensive. If teachers will take the trouble to study the great poets, they will find abundance of matter from which to make their selections. However, it is an advantage, indeed it is almost a necessity, that each child should see a printed copy—a word-picture, that is—of the piece chosen for Recitation; therefore, when the selections have been made, the teachers should look through the publishers' lists to see which pieces of their choice are sold separately.

In the teaching of this subject, as well as in Singing, loudness should be avoided. The marks given in Singing and Recitation have frequently to be lowered on account of the children's tendency to shout what they have learned. It is a painful experience also for an inspector to be told, after three or six months' work has been done in a school, that the class has only at present learned a few lines of the year's work. To chop up such pieces of Recitation as "The Two Little Kittens" or "The Mouse and the Cake" is to make the teaching of Recitation a gross absurdity; yet one finds this kind of thing going on, and sometimes pieces are presented in the lower standards which are more baby-like than those which the children have learned in the infant school. Short, simple pieces should be learned straightway where possible, while the ideas contained in the lines are fresh and of interest to the children. During the later months of the year the time can be well spent in perfecting the delivery of the pieces, should this be found necessary.

The Singing lessons need great care as regards the time given to them and the conditions of the air. It is simply cruelty to keep children singing, without variety in the lesson, for half an hour or more in an ill-ventilated room. Before each lesson in this subject is given, the teacher should be satisfied that the room is, or has been, properly ventilated. Even then the more delicate boys and girls should not be allowed to distress themselves by singing for too long at a time. We have heard of Singing as a cure for chest disorders or for consumption, but let us indulge in this cure under medical advice. Our duty is to see that the children perform their Singing lessons rationally and under healthy conditions.

MUNICH KINDERGARTENS.

BY A CORRESPONDENT.

THIRTY years ago an eminent Munich physician, Dr. Martin, became interested in Froebel's ideas, and founded the Munich Kindergarten Society, which has for its aim "a popular education that will strengthen and develop the bodies and souls of children according to the principles of Friedrich Froebel."

For many years following, the Kindergarten struggled against prejudice, especially that of the politicians, clergymen, and school teachers. The society's funds for a long time consisted chiefly in proverbial German patience, which was diligently employed in waiting enthusiastically for the opposition to be overcome by the power of the ideas represented. Kindergartens did not enjoy any popularity in Munich until social democratic tendencies began to make rapid strides toward dominancy in German politics. During the last decade the progress has been steady, and very recently the Munich authorities have recognised the kindergarten as a philanthropic institution worthy of assistance. At present the society's kindergartens are given furnished rooms in the city schools, and each new school building is planned to contain a kindergarten department. The society is now looking forward to the incorporation of the kindergarten in the city educational system. The realisation of this hope is so far removed in time that it seems an ideal condition of affairs, in which all the ills the Munich kindergartens now experience shall cease. "We will never see this consummation," says a young and hopeful kindergarten director in her report, "but our pupils' grandchildren probably will, if our surely-moving Germany hurries along with acceleration unabated."

The society determines the course of study, and employs and pays the teachers. The business of the society is conducted by an annually-elected committee of men, of which the Mayor of Munich is honorary chairman. Social matters —exhibitions, benefit concerts, and the like—are in the hands of a large committee of prominent Munich women. Any person may become a member of the society for one year by paying two marks. Bequests, contributions, money lotteries, admittance fees to kindergarten exhibitions and benefit concerts, are sources of considerable income. The society now has twelve kindergartens, open daily, except Sundays, during forty-eight weeks of the year. The average daily attendance is over one thousand pupils. Children from three to six years of age are admitted at any time. The kindergartens are not free. The tuition for one pupil is two marks a month, with one mark a year additional for kindergarten materials. If several children from one family attend at the same time, all except one are admitted at half-price, and the youngest need be but two and one-half years old. In case of poverty the fee is remitted at the request of the parents. Such remittances are comparatively rare, as the society's lack of means compels it to locate its kindergartens in the wealthier districts, where tuition is gladly paid.

Each kindergarten is housed in two rooms: one, for playing circle games, contains a piano, closed cupboards for the children's wraps, and benches against the walls; the other room, for work, contains low tables surrounded by long benches, to which pupils of various sizes are no more adjustable than elsewhere in the world. The pictures on the walls, for illustrating stories, are of far less artistic merit than a foreigner expects to find in the schools of an art centre like Munich. A crucifix hangs on the wall in each room.

A three years' course of study exists: the constant change of pupils, the lack of materials and qualified teachers, and the large classes, are urged as reasons for not following the course closely. The occupations practised are building, stick-laying, tablet-laying, paper-folding, and weaving. A little sewing is done; cutting and pasting were introduced recently; modelling is to be introduced soon; nature study and gardening are matters of the future entirely. The children take home and keep the things they make. There is little or no attempt made to decorate the kindergarten with children's work. Stories are told to the children. Greatest stress is laid upon the circle games. The play idea is minutely explained first, then the words of the song are committed, much care being taken to secure accurate pronunciation, and finally the game is played. Whenever the weather permits, school is held out on the playground, under the trees or canopies.

The kindergartens are opened at eight o'clock in the morning. Until nine o'clock the children entertain themselves, under the supervision of a teacher; school then opens with a song and prayer. Tardiness is not considered a crime, and opening of school is not unfrequently postponed until the greater number of the less punctual arrive. Circle games are played until ten; occupations follow until half-past ten. The children then march into the playroom, sit on the benches along the wall, and eat luncheon from their baskets. Occupations are resumed at eleven; at half-past eleven games begin, closing with prayer at twelve o'clock. During the afternoon session, begun at two o'clock, games are played a half-hour, occupations continue till three, luncheon and games fill the time till four. Thereupon the children go home, unless the parents desire to have them remain and entertain themselves, under the supervision of a teacher, until six o'clock. Corporal punishment is not absolutely forbidden.

Each kindergarten has a head-mistress, an assistant, and two practice teachers. The kindergartners and teachers are under the general supervision of Miss Julia Böck. Teachers' meetings are of rare occurrence. The training of the practice teachers is effected by personal suggestions from Miss Böck, chiefly, however, by observation and imitation of the work of the head-mistress. A thorough study of the theory involved is exceptional. The practice teachers practise twelve months; then, if their progress warrants it, they are promoted to the kindergarten, which is under Miss Böck's special supervision, where they practise from one to six months longer. If their work here proves satisfactory, they are employed as substitutes for teachers who are on the annual six weeks' furlough, until vacancies occur. The practice teachers receive no pay, and are free to secure positions elsewhere. There is no lack of practice teachers. Munich girls are preferred. They come equipped with the equivalent of a grammar-school education; frequently they come with one year of training in a private kindergarten seminary, which, however, does not shorten the time they must practise.

The regular teachers receive £25 to £50 a year, according to the number of years they have served in the society's kindergartens. A teacher in the city schools receives £50 to £65 salary, and is granted a pension upon retirement. Were the kindergarten made a part of the city school system, the whole number of teachers eventually *pensionnaires* would increase ten to fifteen per cent. This might not increase taxes so much as it might curtail the salaries and pensions of the school teachers, many of whom avow they never think of this when defending their lack of sympathy with the kindergarten movement.

The Munich kindergartners make little effort to get into close contact with the homes. Their generally well-kept pupils do not inspire that missionary zeal which follows the ragged and dirty charity pupil into garrets and cellars. The mothers, and especially the grandmothers, of the pupils appear in great numbers at the kindergarten festivals and exhibitions, generally given in large beer-gardens. Mothers' meetings for the discussion of the education of children are considered inexpedient. "Visitation forbidden," prominently placarded at the entrance of German schools, is a legend under which the German pedagogue has developed an exclusiveness scarcely equalled by the royalty in palaces. Tradition—and, next to patience, reverence for the traditional is the German's strong point—exacts that the teacher shall exhibit a conscious intellectual superiority which permits no parental suggestion to approach from afar, even though brought on hands and knees. Bismarck's observation, "We Germans fear naught but God," may apply to the nation as a whole, but the individual German never quite outgrows his fear of the schoolmaster. Consequently the little squares of coloured paper inscribed "Welcome," and pinned on some of the Munich kindergarten doors, are passed unnoticed, or are regarded as the mischief of some incorrigible within.

THE CODE OF NINETY-NINE.

WE have no prize-packet in store for our readers. Even the *block grant* that has been so graciously vouchsafed to our Scotch brethren finds no place in Sir John Gorst's latest budget of behoofs, to which the knights and dames of the chalk and duster will soon be giving their rapt attention.

Matters, then, being not of the bolt-from-the-blue kind, we may content ourselves with noticing *seriatim* the various changes that have been made in the Code for 1899.

No longer may the attendances of a scholar *employed habitually as a monitor be counted*. Before a school can be placed on the annual grant list, the Department must be satisfied that it has "visible means of support," or, in Departmental phraseology, "reasonable prospect of adequate financial support." There is this year a little more disposition to honour by adoption the recommendations of the Departmental Commission on the pupil-teacher system, as will be seen from the following:—

> 33. Boys or girls over thirteen and under sixteen years of age may be recognised as probationers, provided that they are approved by the Inspector, and provided that the managers undertake that they are employed with the intention that they shall subsequently enter into engagements as pupil teachers in the school.
>
> The managers are bound to see that probationers are not permitted to serve in school during more than half the time that the school is open; and that they receive suitable instruction during the term of their employment.
>
> Certificates of health and character, and, in the case of girls, of proficiency in needlework, must be furnished for probationers proposed for recognition under this Article.
>
> In April 1899, probationers who have been prepared for presentation in accordance with the Code for 1898 may be examined at the collective examination, if they so desire; but they can be recognised without examination, provided that they satisfy the conditions stated above.
>
> In October 1899, and subsequently, there will be no examination of probationers.

Secondary Schools are now recognised as proper places whereat pupil teachers may receive their instruction "under conditions approved by the Department."

Two adult teachers must be employed in every school after January 1, 1900, where pupil teachers are employed.

There is another new article relating to pupil teachers, in the shape of Article 40,* which reads as follows:—

> 40* [NEW.] For pupil teachers admitted from July 1, 1900, or any later date, the length of the engagement will ordinarily be three years, but may be two or one, provided that (*a*) the candidate passes the examination prescribed by Schedule V.* for the first or second year, and (*b*) the end of the reduced term of service falls beyond the completion of the candidate's eighteenth year.
>
> On and after July 1, 1900, no candidates will be admitted for an engagement of more than three years, except where the Inspector specially consents (Article 39) to their admission under fifteen years of age. In such cases the length of the engagement will be four years, and the candidates will be required to pass an examination in Standard VI. or VII. in the three elementary subjects and the elements of grammar, geography, and history.

The number of pupil teachers may now be two for the principal teacher (or three in the case of pupil teachers already recognised) and one for each certificated assistant, except that in the case of teachers taught at Central classes the latter number may be two—presumably that the teachers may spend half their time in school and half at the Centre.

Graduates of any university in the British Empire may now become certificated teachers, provided the said university obtain recognition from the Government for this purpose, and provided always that they satisfy the Department as to Article 57 (1.) (*a*) or (*b*).

Superannuation.

> 60. A teacher certificated after April 1, 1899, will not be recognised as a certificated teacher until the Department are satisfied in the manner prescribed by the Elementary School Teachers Superannuation Rules, 1899, of his age and physical capacity.

In addition—

> 67* [NEW.] The certificate of a teacher, who becomes certificated after April 1, 1899, shall expire on his attaining the age of sixty-five years; or if the Department, on account of his special fitness, allow his service to continue for a further limited time, then on the expiration of that limited time.
>
> The provisions of this Article shall apply to teachers certificated before April 1, 1899, who accept the Elementary School Teachers Superannuation Act, 1898, with the following modification, that is to say:—If the teacher has at the date of the acceptance of the said Act attained the age of sixty-five years or any greater age, the date of such acceptance shall be substituted for the date at which the teacher attained the age of sixty-five years (Elementary School Teachers Superannuation Act, 1898, sections 1 (2) (*a*) and 5 (2) (*b*)).
>
> In view of the provisions of the Elementary School Teachers Superannuation Act, 1898, attention to this rule—namely, the intimation of appointment—is specially necessary in the case of certificated teachers.

The shortcomings of the master are not to be visited on the pupil teacher who may be apprenticed in a school controlled by a head-teacher not qualified to take pupil teachers, if (*a*) the pupil teacher attend Central classes, and (*b*) the head-teacher be recommended for practical skill.

The Agreement Article has become a little more drastic,—

> The Department may refuse to recognise any principal teacher appointed after April 1, 1900, who is not engaged under this form, or under some other form specially approved by the Department;

but it still lacks logic, inasmuch as it is not wholly compulsory.

Visits.—These are gradually crystallising into two. In the case of an examined school there is to be one without notice, plus the annual show day; whilst the 1884 (*b*) school is to have, "as a rule," two visits without notice.

The Audit.—Relaxation seems to be the order of the day here, since "on special application to the Department," some other person (other than a bank manager, etc.), "not being a manager or treasurer of the school, whose competency is proved to the satisfaction of the Department," may audit the accounts. There will be no chorus of approval here.

Change of Head-teacher.—In an infants' department the Department now propose to allow a three months' period of grace during which the reduction from 9s. to 7s. will not be made. The new matter is as follows:—

> 98. (*a*) (ii.) 7s. where the above special conditions are not satisfied, but the grant may continue to be paid at 9s. in respect of the first three months of the time (exclusive of the ordinary school holidays) occupied by any interval or intervals in any school year between the leaving of one and the coming of another teacher qualified under the last preceding paragraph of this Article.

We do not welcome this as calculated to incite managers to extra diligence in filling up vacancies; rather will it act as an incentive to dilatoriness in filling up the gap occasioned by the departure of the head-teacher.

The same leniency (mistaken, we believe) is to be shown in the case where infant classes of more than thirty are not in the charge of "a teacher of eighteen years of age approved by the inspector." Here, again, "the first three months" is substituted for "none at all."

Recitation.—"*Generally speaking*, the scholars *should* be able to recite *not less than* twenty lines of poetry in Standard I.," etc. This means that more will be welcomed, but that less or more may, under very exceptional circumstances, we opine, be given. As giving a little more freedom to the already free school, this regulation accords with the spirit of latter-day Codal legislation, and is therefore to be counted for righteousness, as indeed are most of the changes of our time.

Specific Registration.—The Department has seen the error of its ways in two respects here. In the first place, not less than twenty hours may be counted, but more than sixty hours' instruction in specific subjects may be given, provided always that not more than sixty hours may be counted for grant-claiming purposes. This is another common-sense little change whereat none but a crank can cavil.

Laundry Work.—The teacher must be certificated, or otherwise recognised by the Department, a record of instruction must be kept, and not more than forty-two children can now be present at a demonstration.

Admission to Training Colleges.—Graduates or those possessing certificates recognised under Schedule VIII. may now be admitted *ad lib.* for a course of training. The Department, however, enacts that a limit may be put to the number thus admitted.

Pensions.—An increase of £1,000 and the following note are the only points to record under this heading:—

> (8.) No person will be eligible for a pension under this Article who has accepted the Elementary School Teachers Superannuation Act, 1898.
>
> Provided that, if a person who has accepted the Act is proved to the satisfaction of the Education Department to be unable to qualify for an allowance under the Act, he may be granted a pension under this Article not exceeding £20 per annum.
>
> (9.) No person who has completed the sixty-fifth year of his age before April 1, 1899, will be granted a pension under this Article unless his application is made before April 1, 1900.
>
> (10.) No person who is under sixty-five years of age on April 1, 1899, will be granted a pension under this Article unless his application is made within three months of his attaining the age of sixty-five.

Drawing.—Scale drawing is now to be taken in both Standards VI. and VII.; whereat there should be no complaint.

Schedule V.*—After the present year, the new schedule, now marked Schedule V.*, is to come into force. We cannot, as we should like, give it *in extenso*. It must suffice to say that the general tendency is in the direction of the more liberal education of the pupil teacher, and especially of the girl pupil teacher. Most of the syllabuses have been recast, and many a word will have to be said between now and next year as to the wisdom or unwisdom that has been shown in the process. But neither time nor space will allow us longer discussion of this interesting question at this juncture; so, perforce, we close our short article in stating that the rules as to building and equipment have wise if simple revision, and express our satisfaction that the Code for 1899 breathes the same benign spirit of trust in the teacher that has so happily given complete educational peace in our time.

THE EDUCATIONAL WORLD

A REVIEW OF EDUCATIONAL TOPICS AT HOME AND ABROAD.

EDUCATION IN ENGLAND.

N.U.T. NOTES, ETC.

BY T. B. ELLERY, F.R.G.S.,

President of the National Union of Teachers, 1895–96.

The N.U.T. Cambridge Conference. Once again Conference is upon us. Is it possible that a year has flown since we were shaking hands at Cheltenham? In a few days we shall once more be renewing old friendships and taking part in the usual Conference-week programme, all too much engaged and all too happy possibly to give a thought to the past. And yet perhaps there will be one reminder of the year that is gone—a great loss, to which reference will be made at almost every gathering in Easter week. I refer to the death of our dear friend and comrade C. J. Addiscott. Who can forget him?

It is an open secret that the retiring President is permitted to select the mover and seconder of the vote of thanks to himself when he leaves the chair. I have "C. J.'s" letter before me (he was always "C. J." to many of us), in which he said he would be glad if I would undertake the duty of moving the resolution. That was at Cheltenham. Of course I accepted the responsibility; but if I had known what was to happen within a few months, I fear— But fortunately these things are hidden from our view. I do not like to think of the almost tragic end to such a life of usefulness. He is gone, but we who knew him best will never forget him. We shall miss him at Conference, as we have missed him at our executive meetings, and many a word of regret will be spoken as his name rises to our lips.

The Event of the Week. The great function of the week will be the conferment of honorary degrees upon our respected General Secretary, Mr. J. H. Yoxall, M.P., and the coming President, Mr. T. Clancy. This will take place in the Senate House, on Tuesday at 2 p.m.; and it will bring back to our minds the honour conferred by Oxford University upon Mr. Ernest Gray, upon which occasion I had the privilege of voicing the Union's appreciation of the compliment. It is certain there will be a great gathering in the Senate House on Easter Tuesday. Oxford did well; Cambridge does even better. I am quite sure every reader of THE PRACTICAL TEACHER will congratulate the Union's representatives upon whom this great honour is to be conferred. Mr. Clancy may well be pleased that Mr. Waddington was the successful candidate for the Vice-Presidency in 1897. The coming President gains considerably by the temporary defeat. He missed the chair of the Union for a year; he has gained a degree.

I congratulate my good friend Mr. Yoxall, the able and genial Secretary of the N.U.T., in whose well-deserved success I rejoice; and I congratulate with all my heart my old colleague and friend, the coming President. Let us hope that for many years to come the able pen of the Secretary and the ready tongue of Mr. Clancy may be at the service of the great Union for which they have already done so much.

Other Functions. Clearly it is to be a week of "functions." We begin on Sunday with an "At Home" (Mrs. F. W. Myers), and on Monday with a reception from the University and from the townspeople, and this promises to be a "best on record." Then from 8 to 11 p.m. there is to be a reception at Newnham College. On Tuesday, followin the conferment of degrees, there will be a reception b the Vice-Chancellor in the Fitzwilliam Museum at 3 p.m. At 7 o'clock Trinity College Hall will open its doors to enable representatives to partake of the usual Conference dinner, while for those who prefer music there is to be a high-class concert in the Guildhall at 8 o'clock. By the way, I had forgotten to mention the National Temperance League breakfast at 8 o'clock in the morning, and the Voluntary school teachers' meeting at 5 p.m. Surely this "programme" for Tuesday should satisfy the most exacting. On Wednesday evening we are to have a Bohemian concert at Homerton College, on Thursday afternoon the reception of purses and awards of trophies, and on Thursday evening the Conference ball at the Guildhall. I have said nothing as to the College reunions, the excursions, etc., etc.; for representatives may not have full particulars before them until they reach Cambridge—at any rate, so far as the reunions are concerned.

And now to Business. Naturally, the chief feature of the opening session will be the installation of the new President, whose address, we may be tolerably sure, will deal with Superannuation, the Relations of Primary and Secondary Education, and Child Labour. There will be, if I mistake not, the true educational ring about the address, and at the same time there will not be wanting signs of the deeply-rooted convictions of the honest, manly Roman Catholic teacher. The members of the N.U.T. have for the first time chosen a Roman Catholic to be their leader. I do not think they will ever regret the choice they have made. After the address we shall have the usual deputations, including our Cheltenham friend "Van Dam" from Rotterdam, and Miss C. Webb and Mr. W. T. Carter, who will represent the Co-operative Union. By the way, this is the first time, I believe, we have had a lady to do the honours on behalf of the co-operative movement. The session will close with the announcement of the re-election of Mr. G. M. E. Hamilton to the office of Treasurer. I take this opportunity of congratulating Mr. Hamilton upon this further mark of confidence, and the Union upon its good fortune in being able to secure a continuance of his services. For nine years, when I served as chairman of the Finance Committee of the Union, I was, of course, thrown into close contact with Mr. Hamilton, and I am able to testify, therefore, to the careful and thorough way in which he does his work. On financial matters he is an expert, and that, I take it, is the kind of man we want as Treasurer. Should Conference, at this meeting or later, make the office a paid one, then surely the man for the post is Mr. G. M. E. Hamilton.

Tuesday's Proceedings. For an hour and a half on Tuesday morning the ladies will have the field to themselves. Mrs. Bryant, D.Sc., leads off with an address, after which, if the order of the agenda is followed, we shall deal with the Leeds resolution *re* infants' schools, which asks that the efficiency of an infants' school should not be judged by the results obtained in the elementary subjects, but by its tone, character, suitability of methods employed, etc. We shall then ask that the grants for infants' schools shall be at the same rate per head as for older scholars, and shall then pass on to deal with the salaries of mistresses—(1) that girls' and infants' mistresses of the same professional status, working in the same school, should be paid at the same rate of salary; and (2) that class mistresses employed in boys' and mixed schools should be paid on the same scale as class masters. Ladies have long been asking that a greater share of the ime of Conference shall be devoted to their interests than has been the custom in the past. *Now is their opportunity!*

At 11.30 we shall undoubtedly have a treat in Professor Jebb's paper on "The Relations of Primary and Secondary Education," whether we all agree with his conclusions or not. The time remaining before the close of the session will be devoted to (1) the Educational System, and (2) the Training and Qualifications of Teachers.

Wednesday's Doings. We shall open with Compulsory School Attendance, and as this is not likely to occupy much of our time (as we are all "agreed"), we shall soon be busy with Teachers and Federation Governing Bodies, which has been entrusted to Messrs. Rankilor and Blacker. If all is well, I shall follow with a comprehensive resolution dealing with Superannuation, which I hope will meet the wishes of those who view with anxiety the operation of the draft rules, and also of those who look upon sixty-five as too advanced an age for retirement.

Our friends must bear in mind our past experience, and not expect everything at once. We must *hasten slowly*. At any rate, I trust it will be conceded that we have done all that was possible under all the circumstances. Arising out of Superannuation is, of course, the question of Reasonable Security of Tenure, and this resolution is in the able hands of Messrs. T. H. Jones (chairman of our Tenure Committee) and T. P. Sykes. It is almost impossible to deal with the whole of the subjects down for discussion. There are: 1. Staffing of Schools; 2. Large Schools and Classes; 3. Log-book Entries and Private Reports on Work of Class Teachers; 4. Evening Schools; 5. Registration of Specific Subjects; 6. Universities and Education; and 7. Appointment of Inspectors. In the afternoon Messrs. Waddington and Pickles will deal with the Half-time Question and Child Labour; Mr. Peaker will once more denounce the continuance by some Board inspectors and organising masters of detailed examinations of children in elementary schools; Mr. S. Hicks and Mr. H. N. Cohen will eloquently (that may be taken for granted) discuss the grievances of certificated assistant teachers; Messrs. Bowers and Phillips will have some strong things to say as to organising visitors; Messrs. Graves and Hurden will ask that the public district auditor shall audit all school accounts; and then, if there is time, we shall deal with Examinations in Religious Instruction, the Teaching of Drawing, Teachers' Position at Transfer of Voluntary Schools to School Boards, Calculation of Average Attendance, and the Decimal System. Several of these deserve a better place in the agenda, though I am aware of the difficulty in arranging all the items in order of importance. The Decimal System, for example, deserves a place of honour. England will never be able to compete successfully with certain European countries while her teachers spend so much time in teaching a really absurd and illogical "system" of money, weights, and measures.

The Private Sessions. We are to spend in all eight and a half hours in the discussion of "domestic" matters, when reporters other than those of the educational press will not be admitted. (Monday evening, 5 to 7.30; Wednesday evening, 5 to 7.30; and Friday morning, 9.30 to 1.)

During this time representatives are free to attack the balance-sheet, the actions of the Executive, and any and every thing else which may occur to the mind of the zealous unionist. Not that all the time is occupied in this way. Much useful "legislation" is generally effected, and this year the opportunities in this direction are great. We shall hear what Dr. Macnamara and Mr. Blacker have to say in favour of the appointment of Mr. A. A. Thomas, B.A., to the office of Secretary to the N.U.T. Examinations Board. In all probability there will be a lively discussion, but, provided it is kept within fair limits, this will be welcomed by the Executive. We shall ask for powers to "devise, adopt, place at the disposal of members of the Union, and make arrangements for carrying out a system of insurance in connection with the contributions made by teachers under the Elementary School Teachers (Superannuation) Act, 1898," and shall then pass on to discuss the amalgamation of the Union funds, grants to district unions, alterations of rules, representation at Conference, admission of ex-pupil teachers as members, Sustentation Fund, unprofessional conduct, Charter of Incorporation, etc. The "supplementary agenda" is again a formidable affair, but in the majority of cases the resolutions contained therein appear in another form in the arranged agenda from Monday to Thursday.

It is to be a busy week. Many things, I fear, will be said which will be regretted when the excitement of the week is over, and one can only hope, therefore, that fair criticism, and fair criticism only, will be indulged in. It may not be out of place to remind some that even officials and members of the Executive have feelings and a measure of self-respect, whatever may have been thought with respect to this in the past.

Rural Teachers at Conference. Our friends the rural teachers have decided to be in evidence during the Conference week. Their decision is a wise one, for the greater publicity given to the conditions under which teachers in the country districts work, the greater hope there is of reform. The National Federation of Rural Teachers will hold its annual meeting at 8 o'clock on Monday evening, and on Wednesday evening at 7.30 a conversazione, organised by the same body, will be held, when addresses will be delivered by Dr. Macnamara and others.

I gladly give these particulars, and trust that the secretary (Mr. Winfield) will meet with great support in his efforts to make both gatherings successful.

The Superannuation Draft Rules. Many members of the Union have written to me with respect to the rules which will govern the administration of the Superannuation Act. I confess it appears to me that there has been an over-anxiety on the part of those responsible for these rules to prevent any exploiting of the fund, and too little consideration for those who may be compelled to seek disablement allowances. Neither do I like the inquiry as to the financial position of the applicants. If Superannuation is to be in any sense a boon, it must be generously administered, and teachers must be treated as men and women who, having given their lives to the service of the State, and having contributed to the fund, *have a right* to the benefits which the Superannuation Act was intended to confer. However, I have no fear as to the ultimate working of the Act. There may be a few misunderstandings at first, but with Sir George Kekewich at the Education Department, and with Messrs. Yoxall and Gray in "the House," anything, in the long run, of a very serious character is impossible. I wonder how many teachers will avail themselves of the Act immediately it comes into operation. A neighbouring teacher writes to me to-day to say that he will be one of the number.

EDUCATIONAL NOTES.

BY CATHERINE I. DODD,

Owens Day Training College, Manchester.

Military Training in Education—Nature-lore and Handicraft Classes—Some Problems of Babyhood—Study of Temperament.

"The Parents' Review" and Military Training. In discussing "Military Training as a Factor in Education," in the March number of *The Parents' Review*, Mr. A. W. Gundry points out the inadequacy of gymnastic training in many of our schools. He says: "In primary schools, and others that have no gymnastic apparatus, children are generally put through a course of manual exercises. These are said to be arranged scientifically to suit the human anatomy; but the want of a further object, and the lack of faith in both instructor and pupils, render them dreary and lifeless."

In urging systematic military training in the schools, Mr. Gundry points out the successful organisation of the Church Lads' Brigade and the Volunteer Cadet Corps—the one working among boys of the poorer classes, and the other among boys of the richer. In connection with the Lads' Brigade he shows how attractive the military organisation is—how, on the basis of military drill, football clubs, swimming classes, etc., are formed, and how in summer various companies encamp by the seaside. Probably the military organisation of the German school journeys, which induces regularity, law, and order in the long marches, and sometimes uncomfortable lodgings for the night, adds to the

success of these excursions. If the Lads' Brigade can camp out at the seaside with perfect order and good feeling, it ought not to be impossible to arrange school journeys in connection with the upper classes of our primary schools.

Nature-lore and Handicraft Classes. Miss M. A. Clapperton tells us that these classes, held last summer during the month of August, at the little village of Darvel, Ayrshire, formed a holiday course of an unusual type. Nature-lore was made the central study, and all the other subjects were more or less viewed and treated in relation to it. "By means of rambles over the country-side and on the seashore, talks on trees, plants, common animals, birds, etc. (made living by observation of great numbers of specimens, viewed whenever possible in their natural surroundings and in life), the attempt was made to help the student to enter into a direct relation with nature. Then he was encouraged to reproduce with his brush some natural object that had struck him—a leaf, a simple flower, a shell, a fungus."

Brush-work, clay-modelling, leather-embossing, wood-carving, and brass-work were among the handicraft classes. The scheme was originated by a young Ayrshire manufacturer, and among the students of the holiday course were teachers, designers, weavers, and mill-workers.

Problems of Babyhood. Mrs. Mumford gave a paper at the Manchester Child Study Association on "Some Problems of Babyhood." The first three years of the child's life she roughly divided into the first eighteen months and the second eighteen months. During the first period the formation of bodily habits is of prime importance, while in the second period this is of secondary importance. Training in obedience is at first only a matter of the gradual formation of habits through the unconscious diversion of attention. When the baby's will begins to assert itself and he becomes consciously obedient or disobedient, the parents' problems begin. A mother's intuition is a great factor, but it cannot be trusted to alone; it needs to be supplemented by observation and careful study. Half the difficulty in training children is due to our clumsy mode of going to work. We are over-insistent in exacting obedience in details, forgetting the principle which overlies the details. We go one step too far, and there is a struggle—a struggle which is harmful, and which could have been avoided with greater wisdom.

After giving two or three instances of too much being demanded of a tiny child of two years, Mrs. Mumford asked, Why are we so clumsy in our method (or want of method) of training our children? Mainly because, even while we have an intense love for our children, and desire to do the best for them, we have no clear idea of what we want them to become. Nor have we any clear conception of the broad general laws which we wish to follow in our treatment of them. Quoting Mrs. Bryant, the speaker showed that we want more than nicely-behaved children; we want to train them to be "self-denying, brave, confident, humble, and honest."

Mrs. Mumford next considered the nursery problems under the heads—Obedience, Anger, Fear, Shyness, Cruelty, Jealousy, Self-control.

Concerning obedience, she urged for the restrictions to be as few as possible, and as the child's reason develops, the reasons for the restrictions should be given. Freedom must be permitted as far as possible, and the child is never to be thwarted if it can be helped. Constant checks to the baby's initiation are irritating, and tend to create in him a desire for rebellion. Interesting illustrations were given of Mrs. Mumford's method of training her boy in *sympathy* rather than *conscious deliberate obedience*. The child learned readily to obey in response to the fascination of a suggestion.

The same general principle underlies the baby's moral training; the idea of the good action is made so attractive that the desire for rebellion is not roused, and the suggestion is readily followed.

Selfishness is to be treated by training in unselfishness. Anger can be frequently avoided by making the act you wish to be done, and which you know is repellent, attractive.

Fears can sometimes be treated by arousing the child's interest in the dreaded object, and thus making curiosity by itself drive out fear; and on the same plan jealousy was prevented by making the object of jealousy attractive.

In conclusion the speaker affirmed that this habit of response to suggestions—a habit established in the first place mainly by means of making such suggestions attractive—is the foundation of the child's training in unselfishness, in control of anger, fear, and shyness, in freedom from jealousy. Moreover, the child's will is in this way brought into harmony with your will, because he responds naturally to your suggestions. Thus the power of human sympathy is developed, and even baby is taught that goodness means happiness and love.

Likes and Dislikes. Dr. Mumford addressed the Manchester Child Study Association on "Temperament, or Likes and Dislikes." The following gives a brief sketch of the points he dealt with:—

Likes and dislikes depend upon the peculiarity of children more than upon the objects presented to them.

The behaviour of children to new objects can be expressed largely in terms of fear or of curiosity, except in the case of dull children, where no emotion is aroused.

In the case of nervous children, the intensity of stimulation of the sense organ often determines whether a new organ will awaken fear or curiosity.

Specific conduct before special experiences not frequently inherited and instinctive, but more often acquired.

Temperament—both bodily characteristics and mental characteristics. Temperament varies with stages of life, and different temperaments tend to show their highest development at special ages.

The dangers of the breakdown of nervous temperaments in city children.

EDUCATION IN SCOTLAND.

E.I.S. NOTES, ETC.

BY JAMES PATERSON,

Ex-Vice-President of the Educational Institute of Scotland.

Inverness Branch, E.I.S. THE chief item on the programme of the Inverness Branch of the Institute at its quarterly meeting was "Superannuation." The branch was invited to discuss the following points, of which notice had been given:—That the Inverness Branch, while approving generally of the principle of superannuation now established, and of compulsory retirement of teachers in elementary schools, regrets that (1) the pensions are inadequate; (2) the contribution from Government is too small in proportion to that paid by the teacher; (3) the right of School Boards to supplement pensions has been withdrawn; (4) the age for retirement is too advanced; (5) no part of the contributions is to be returned in the case of death before reaching the age limit. The outcome of the discussion was a resolution to induce the General Committee of the E.I.S. to take immediate steps to secure such amendments to the Act as will remove the objections referred to. Many other branches have had the scheme under consideration, and in almost every case resolutions to the same effect have been adopted.

Higher-Grade Science Schools. At a recent meeting of the Dundee Branch of the E.I.S., Mr. Andrew Blackwood read a paper on "Higher-Grade Science Schools." Mr. Blackwood gave it as his opinion that science teaching to the standards was a failure. He would not abolish the teaching of science altogether from the elementary classes, but he would depose it from its present high position of a class subject, and teach it in the form of object lessons. He was of opinion that the higher-grade science schools would be of great advantage to lads who meant to become tradesmen, and he expressed the hope that, while other places were taking action, Dundee would not lag behind. Mr. Blackwood will, doubtless, be pleased to find that his ideas on the subject have been embodied in the New Code.

Perthshire Branch, E.I.S. The Perthshire Branch of the E.I.S. has had the suggested scheme of graded salaries for assistant teachers under consideration, and has adopted the following resolution thereanent:—"That this branch of the Educational Institute desires cordially to express approval of the proposed scheme of salaries, and in

the interests of education would beg to recommend it heartily to the consideration of all school boards in the district." The scheme, which has the support of the Educational Institute, is very generally acceptable to assistant teachers, though some of the women are dissatisfied that there should be any differentiation in regard to sex. As to the efficiency with which the women do their work, as compared with the men, there cannot be two opinions; but the question of equal remuneration raises other considerations which are still open to debate. The ladies would, meantime, be well advised to push the scheme, and their other demands may follow.

Code Pensions. The Lord Advocate has stated, in reply to a question in the House of Commons, that the Code pensions are to be maintained for the present, and that the date from which a teacher should have served in order to become qualified for one of these pensions has been altered to August 6, 1872, when the Education Act was passed. Teachers who accept the terms of the Superannuation Act are, however, expressly debarred by Article 118 (3) of the New Code from obtaining the Code pension in addition.

Dundee Branch Conversazione. The annual conversazione in connection with the Dundee Branch of the E.I.S. passed off most successfully. An interesting feature of the proceedings was the presentation of a silver bowl to Mr. John Mudie, the secretary, as a token of the branch's appreciation of his services, and also in commemoration of his silver wedding. The chairman, in making the presentation, said that Mr. Mudie was recognised all over Scotland as an enthusiastic worker on behalf of the Institute, and his merits had been acknowledged by the general body by his election as a vice-president. In the name of the members of the branch, he expressed the hope that Mr. and Mrs. Mudie would be long spared to each other. Mr. Mudie, in reply, assured the members that if he could further serve them he was at their call.

Leaving Certificate in Science. In conformity with the proposal contained in Circular 221, the Scotch Education Department intends, in connection with the Leaving Certificate Examinations this year, to give an opportunity to scholars who have received instruction in science according to a three years' curriculum to obtain a certificate. The examination, it is stated, will be chiefly oral and practical, and will be based upon the curriculum of each school, and upon the profession of work done, provided that the curriculum can be regarded as satisfactory in character, and the profession adequate in amount. The standard will, however, be a high and, as far as possible, a uniform one. Only one grade of certificate will be issued, and it will specify the branch or branches of science in which the candidate has satisfied the examiners.

Aberdeen Branch, E.I.S. An interesting address was given at a recent meeting of the Aberdeen Branch of the Institute by the Rev. James Anderson, Dyce ("Fergus Mackenzie"), on Dr. John Brown, the author of *Rab and his Friends*. After sketching the career of Dr. Brown and referring to his writings, and specially to the subject of the lecture, Mr. Anderson spoke of his merits as a writer, and pointed to his vein of romance, his love of natural scenery, and his portrayal of the stern and fierce life of the Covenanters, but above all to his humour and his pathos, which went to produce that very delightful work which had taken its place as a Scottish classic. By way of application the lecturer directed the attention of his audience to Dr. Brown's ideal of a professional man as one who, while a master in the technicalities, could also put his heart into his work; and that, said the lecturer, was the supreme combination, whether in teacher or any other professional man.

Glasgow Branch, E.I.S. At the February meeting of the Glasgow Branch of the E.I.S., Mr. S. M. Murray, head-master of Sciennes Public School, Edinburgh, read a paper on "Manual Occupation in the Various Classes." Mr. Murray discussed the following points in succession:—What form was manual instruction to take, and what were its immediate aims? When and how often was it to be taken? Who should teach it? What effect might it be expected to have on the school work? The training of hand and eye generally was the aim, and consequently the form the instruction should take was of secondary importance. The work, he thought, should be taken in the afternoon, as being more interesting, and involving a minimum of mental strain. The instruction should be given by the ordinary staff, even though imperfectly prepared for it. It directly aided the teaching of drawing, geometry, and kindred subjects, while indirectly it did much good by making school a pleasanter place, and it to some extent improved the attendance.

German Primary Education. The Brechin Local Association of the E.I.S. held a meeting recently at Montrose. A paper on "German Primary Education" was read by Mr. Thomson, the President of the Educational Institute of Scotland. One of the chief features of the German system, the lecturer remarked, was its entirety. The educational ladder was complete, reaching from the infant department of the primary school to the university. Mr. Thomson, in concluding an interesting and instructive address, said the Germans had much to learn from us in reference to school buildings; but in the training of teachers, in methods of instruction, in the dealings of the State with the teacher and the school, Germany had many lessons for Britain.

The Paris Educational Exhibit. At the close of the ordinary business of the above meeting, Mr. Thomson, who is a member of Lord Hopetoun's Committee, made an interesting statement regarding the educational exhibit which it is proposed to send from Scotland to the Paris Exhibition of 1900. All teachers, he said, were invited to contribute, and they would be asked to send in specimens of all kinds of work done by their pupils—maps, drawings, kindergarten work, sewing, and even pupils' exercise books. He hoped that Scottish teachers would do what they could to make it a success and a credit to Scotland.

Presentation to Mr. Christie of Dunblane. Mr. R. H. Christie, who has just retired from the position of schoolmaster of Dunblane, which he has held for forty years, was lately entertained to dinner by his former pupils, and presented with a solid silver tea and coffee service and a casket containing an illuminated address. Mr. Christie, in replying to the toast of his health, took occasion to refer at some length to his work in Dunblane. In contrasting the style of education in vogue in his early days with the science teaching now coming so much into favour, he frankly admitted that he was conservative enough to hold that, without a good grounding in classics and mathematics, a man could not be said to have had a liberal education.

Physical Training in Board Schools. General Chapman's scheme for the physical training of the pupils in Board schools is being discussed by school boards all over the country. Finding that his proposals are in some instances misunderstood, the general has written a letter of explanation, with a request that it should be made public. In this communication he says that he never had it in his mind to establish any connection between the senior pupils and the recruiting department. The great value of physical training has been brought home to him through witnessing the extraordinary improvement effected thereby in the physique of recruits. If the methods used in the army were adopted in our schools, the whole population, he maintains, would be greatly benefited. His scheme is intended to embrace the training of both sexes, and the only measure of drill he recommends is that generally given in the Boys' Brigade.

MORE CHEAP ANTHOLOGIES.

To his series of *Books for the Bairns* Mr. Stead (*Review of Reviews* Office) has just added a delightful collection of *Hymns with Pictures*. The hymns, sixty in number, are popular, pleasing, and varied, and the pictures are still more numerous and very effective. It would be difficult to find a cheaper book than this at a penny.

The new number of the *Penny Poets* is a collection of *National Songs for the School and Home*, Words and Music, edited by R. S. Wood. Here we have nearly eighty songs with the music arranged in two parts, printed in the tonic sol-fa notation. Nearly all the best-known songs of home, songs of the navy, soldiers' songs, patriotic songs, are included. The book is sure to become a favourite, and for cheapness it is a perfect marvel.

NOTES FROM THE NORTH.

THE NEW SCOTCH CODE AT A GLANCE.

Curriculum, Conditions of Grant, Amount of Grant, etc., for each Division of the School.

DIVISION.	INFANTS.	JUNIOR.	SENIOR.	ADVANCED.	HIGHER GRADE SCHOOLS.	
					SCIENCE.	COMMERCIAL.
CLASSIFICATION.	Pupils under 7 Years of Age.	Pupils between 7 and 10 Years of Age.	Pupils over 10 and who have not obtained Merit Certificate.	Pupils who have obtained Merit Certificates.	Pupils who have obtained Merit Certificates.	
CONDITIONS OF GRANTS.	1. Organization and Classification must be satisfactory. 2. Good Manners, Punctuality, Discipline, etc., good. 3. Education according to Scheme approved by the Inspector. 4. Time-table and Scheme of Work (in duplicate) approved by the Inspector. 5. Notices of Holidays and Closing of Schools for Epidemics given fourteen days previous. 6. Record of work kept.				1. No. 2 of other divisions. 2. No. 4 of other divisions. 3. No. 5 of other divisions. 4. Proper provision of Class-rooms, Laboratories, and Workshops necessary for the particular type of Education. 5. Supply of qualified Teachers. 6. Organisation not unduly complicated. 7. Pupils, as a rule, follow out the course which they begin. 8. Course of instruction extends over not less than three years.	
FURTHER CONDITIONS OF GRANTS.				*For Practical Instruction.* 7. Accommodation for practical instruction suitable. 8. Lessons given by properly qualified instructors. 9. Lessons of 1½ hours' duration. 10. Individual work. 11. Classes limited to 18 pupils for practical work, 54 for demonstration.		
CURRICULUM.	1. Physical Exercise (may be Military Drill in Senior Division). 2. Needlework for Girls. 3. Singing by Note. 4. Drawing (with or without Manual Occupations). 5. Poetry. 6. Three R's.	7. Nature Knowledge or Object Lessons. 8. English, practice in speaking of. 9. Geography.	10. History. *After 20 hours per week.* 11. Experimental Science 12. Manual Training, Cookery, Laundry, Dairying, Dressmaking, Practical Household Economy.	1. English. 2. History. 3. Geography. 4. Arithmetic. 5. Drawing (as a rule). 6. Languages, selected. 7. Mathematics, ,, 8. Science, ,, *After 25 hours per week.* 9. Experimental Science 10. Manual Training, Laundry, Dairying, Dressmaking, Practical Household Economy.	1. Physical Exercise. 2. Needlework for Girls. 3. Singing by Note. 4. Poetry. 5. English. 6. History. 7. Geography. 8. Higher Arithmetic. 9. Drawing. 10. Mathematics. 11. Experimental Science. 12. Manual Work (as a rule).	10. Modern Languages (one or more). 11. Book-keeping. 12. Shorthand. 13. Knowledge of Commercial Products.
GRANTS.	Normal Grant 18s. per pupil on average attendance.	Normal Grant 20s. per pupil on average attendance.	Normal Grant 22s. per pupil on average attendance.	Normal Grant 50s. per pupil on average attendance.	First Year's Course, £2 10 0 Second ,, ,, 3 10 0 Third ,, ,, 4 10 0	
ADDITIONAL GRANTS.	6d. per pupil for exceptionally meritorious work. 1s. for separate Infant Department.	6d. per pupil for exceptionally meritorious work. 1s. 6d. for Drawing. 3d. extra for Manual Occupations.	6d. per pupil for exceptionally meritorious work. 1s. 9d. for Drawing. 3d. extra for Manual Occupations. Experimental Science, 12s. 6d. (1½d. per hour per pupil) per 100 hours' attendance. Cookery, etc., 8s. 4d. (1d. per hour per pupil) per 100 hours' attendance. *N.B.*—This Grant in respect of attendances only after minimum number of hours (20) per week.	One-tenth (5s.) for exceptional efficiency. Experimental Science, 12s. 6d. (1½d. per hour per pupil) per 100 hours' attendance. Laundry, etc., 8s. 4d. (1d. per hour per pupil) for 100 hours' attendance. *N.B.*—This Grant in respect of attendances only after minimum number of hours (25) per week.	One-tenth (5s., 7s., or 9s.) for exceptional efficiency.	
REDUCTION OF GRANTS.	6d. for defects of instruction. 1s. observable neglect to teach manners, etc. 1s. omission of essential portion of curriculum.			One or more tenths for same defaults or want of equipment.	One or more tenths for same defaults or want of equipment.	
SIZE OF CLASSES.	For Certificated Teacher . . . . . 60 ,, Assistant Teacher, 79 (*a* or *b*) . . . . 45 ,, ,, 79 (*c*) . . . . 55 ,, Pupil-Teacher 25			Not more than 40. Practical work, 18. Demonstration, 54.	Not more than 30.	

The New Scotch Code.

THE advent of the 1899 Code marks a new era in the history of Scottish education. By the almost continuous issue by the Scotch Education Department of circular and minute during the past year, the country was fully prepared for considerable changes. But we venture to think no one expected such sweeping and far-reaching ones to be given effect to in one year. It may be said, however, that the changes are all in the direction of greater freedom of classification and of a more elastic curriculum, and as such should receive the heartiest welcome from the teaching profession. It may be that in some cases they point to a lengthening of the school day. It must be a matter of great satisfaction to the teachers of Scotland to find that they are so thoroughly trusted by the Department and the Inspectorate, and they would be well advised, as a body, if they did not sacrifice their newly-acquired freedom by a too great desire to pile on subjects in the hope of earning larger grants in order to satisfy the grasping demands of some School Board or body of managers. We have not yet reached the stage of "block" grants, as it is still possible to have the normal grants increased or diminished, while it is permissible, after a minimum number of hours (twenty) per week, to add certain extra-paying subjects to the curriculum. These extra subjects can only be introduced in the Advanced Department after a minimum of twenty-five hours per week. Accordingly the day of comparisons, at once misleading and pernicious, is not yet ended; but if the present Code helps in abolishing these, it is worthy of a cordial welcome.

The more important changes introduced by the New Code may be classified under the following points:—

1. Changes in regard to Organisation, Classification, and Assessment of Grants.
2. Labour Certificates.
3. Higher-Grade Schools—Science and Commercial.
4. Abolition of the Annual Examination Day.
5. Changes regarding (1) Pupil Teachers, (2) Size of Classes, (3) Qualifications of Teachers, and (4) Schedules.

With regard to the first of these, the table which we have prepared shows at a glance the leading changes. It may, however, be interesting to give a note or two with respect to some of the points. The Code is very definite with reference to the excellence of Discipline. Provision must be made that all reasonable care is taken to bring up the children in habits of punctuality, of good manners and language, of cleanliness and neatness, and also to impress upon the children the importance of cheerful obedience to duty, of consideration and respect for others, and of honour and truthfulness in act and word. This is pretty exhaustive.

The subject of Poetry, now included in the ordinary curriculum, means the committing to memory by the scholars of pieces of poetry *of literary merit* (the italics are ours). This shall be a regularly recurring exercise provided for in the time-table, but no set number of lines is prescribed.

It is interesting to note what Nature Knowledge implies. In the Junior Division it means the acquisition by the children, by observation and inquiry, of a knowledge of common objects, natural phenomena, and the surroundings of the school.

In the Senior Division it denotes direct experimental knowledge of the standards of weight and measure (for this purpose simple balances and examples of the common standard weights and measures should be provided, and should be available for the use of the children), practice in applying them, in representing them to scale, and in making simple calculations resulting therefrom; some acquaintance with the natural features, the plant-life, the industries, and the productions of the district.

Practice in speaking English is to be based on the Nature Knowledge lessons, and upon the lessons of the reading book.

History, which should never have been excluded from the ordinary curriculum of our schools, again finds a place. The provision reads: "There shall also be added some knowledge of British History, advancing from an outline knowledge of the main periods to a more detailed study year by year. One of the reading books in use in the Senior Division must be a manual of history, suitable for use as a reading book in that division of the school." This is the only part in the Code which gives an indication that at least more than one set of reading books are required.

Specific Subjects are now out of the ordinary curriculum, though it would seem as if it were still necessary to teach them, in view of the fact that Article 21, which specially refers to the Advanced Department of the school, says: "The grant [of this Department] may be reduced or refused, unless some of the pupils in the Advanced Department reach in the selected subjects of instruction [that is, Mathematics, Latin, or Science] the standard represented by the third stage of those subjects."

A point, too, that deserves attention is that with regard to the grants for Manual Training, Cookery, Laundry, etc. "No payment will be made on account of the attendances of pupils *for more than one* year, unless the scheme of work provides for different and more advanced exercises in each successive year." At present the attendances of girls are paid for three, and in some cases four years, for the same work.

Labour Certificates. The Minute accompanying Circular 223, published in August last, is now incorporated in the Code. We congratulate the Scotch Education Department on thus quietly, and without the opposition usually aroused by an Act, raising the age of leaving school. Examinations for the Labour Certificate are now to be held only on the special application of managers of schools, and no examination for the Labour Certificate will, unless in exceptional circumstances, be held on the occasion of any inspection visit to a school. Again, it is provided that "no child may be admitted a second time to any such examination until three months have elapsed since the date of the examination at which it failed, and must on each occasion be examined in all the three subjects of the standard in which it is presented." Certificates are to be issued by the managers, not by teachers.

Higher-Grade Schools. Higher-Grade Science Schools were practically established by Circular 231. The Code, however, recognises also the Higher-Grade Commercial Schools. This is a step in the right direction, as there are many pupils who desire to obtain a sound commercial education rather than a scientific. By reference to the table, the conditions and subjects will be readily seen.

Abolition of the Annual Examination. Inspection is not yet abolished, but we find it slightly modified in many respects. The Inspector may visit a school at any time, but he is required to give notice of one of his visits for the purpose of examining the pupil-teachers. There can be little doubt that the new method will take off a little of the strain if it is conducted in a right spirit.

Pupil-Teachers. Some important alterations, too, have been made with regard to the articles relating to pupil-teachers. All engagements must begin on the first of July. The Inspector at the visit, of which previous notice has been given, is to examine in reading, spelling, recitation, music, and teaching. A time-table showing the hours of instruction is now required to be forwarded to the Inspector. All pupil-teachers will be required, in each year, to perform an exercise in drawing; and according to the revised syllabus for studentship and scholarship examinations, marks are to be given at the entrance examination for passes in drawing. Pupil-teachers would do well to take note of the alterations.

Size of Classes. The number of children under one certificated teacher has been reduced from 70 to 60, and for an assistant teacher under certain articles, from 50 to 45, and from 40 to 35; and an important provision has been added—namely, "That the Department must be satisfied as to the distribution of staff, as between the various classes, and that in no case are more than 60 children habitually under the charge of one teacher."

Qualifications of Teachers. In connection with the extra grants obtainable for efficient instruction in drawing, an important footnote deals with the qualifications of teachers in that subject. (It seems, however, to refer only to the teaching of drawing for special grants; for, be it noted, instruction in drawing is also a necessary condition of earning the "normal" grants.) "For the present, grants will be made as above (namely, extra 1s. 6d. or 1s. 9d.) where drawing is satisfactorily taught by a teacher not specially qualified in drawing; but such teachers being under forty years of age, must endeavour to obtain a qualification in at least freehand and model drawing, and grants may be withheld if, after the lapse of two years from this date, such qualification has not been obtained. Eventually a qualification equivalent to that of the Elementary Drawing Certificate of the Department of Science and Art will be insisted upon." In order to obtain these qualifications, I note that grants are now to be made for the further instruction of certificated teachers and assistant teachers (Article 79) in drawing and other extra subjects in the advanced department of public schools or in higher-grade schools.

The qualifications for cookery teachers are the same as in previous years; and a teacher of wood-work and metal-work must, as a rule, hold the teacher's certificate in these subjects of the City and Guilds of London Institute, or of some other recognised examining body approved by the Department.

Schedules. The schedule relating to the curriculum of pupil teachers contains one or two changes, notably with regard to practical skill in music and drawing. The fourth schedule, dealing with specific subjects, simply remains as a table of reference in connection with Article 21 (*c*). The fifth schedule, that of class subjects, is dropped; while the sixth, the drawing schedule, is entirely recast to meet the new classification of schools into divisions or departments.

Parchments. Parchment entries are now abolished; this change takes effect at the end of this month.

On the whole, the Code is well thought out; and though there are still embodied in it elements which teachers would like to see eliminated, the improvement already effected is wide enough to arouse a feeling of great satisfaction, and of tolerance in the meantime for the remaining weaknesses.

EDUCATION ABROAD.

BY E. E. FOURNIER D'ALBE, B.SC., A.R.C.S.

THE *Allgemeine Deutsche Lehrerzeitung* quotes a most interesting letter by Frederick the Great upon education. It is addressed to the minister Von Zedlitz, and contains the opinions of the great autocrat on logic, rhetoric, and extinct languages. "Logic," so he says, "must be taught thoroughly, also in the schools of the small towns, so that every one may learn how to make a rational conclusion in his own affairs; that is how it should be.....As regards philosophy, it must not be taught by a cleric, but by a layman, otherwise it is as if a lawyer were to teach an officer the art of war. But he must go through all the systems with the young people, and must on no account make a new system .....But the most rational thing of all is logic; for every one must deliberate upon his own affairs, and if every one were to think correctly, that would be very good.....Latin the young people must also absolutely learn; I insist upon that. Even if they become merchants, or devote themselves to something else, as their genius happens to direct, it is always useful to them, and there will be a time when they can employ it."

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The following passage is characteristic of the *Landesvater:* "That the schoolmasters in the country should teach religion and morals to the young people is very good. They must not desist from that, but must get them so far that they don't steal and don't murder. But, for all that, theft will not cease. That lies in human nature, for all people are naturally thievish, like those who are employed about treasuries and have opportunities for stealing." This is the *Alte Fritz* all over. He had some experience of the world and of his Brandenburgers. When a peasant recognised him in the streets of Berlin and ran away helter-skelter, the king galloped after him, caught him up, and asked him why he ran away. "Because I was afraid," said the peasant. "You are not to fear me, you are to love me," said the king, as he broke his cane across the man's back. But with all his grim humour and his gruff manner, Frederick had a genuine desire for his people's progress. He certainly laid the foundation for that excellent system of education which was later on to become the strength of Prussia and the pride of the German Empire.

* * * * * *

A good deal of opposition is being encountered by the attempts to introduce manual and practical instruction into German elementary schools. The advent of cooks, carpenters, and non-commissioned officers as instructors is not looked forward to with a relish, and is regarded as a degradation of the intellectual in favour of the material culture. If these instructors are not to be introduced from without, the teachers, male and female, must be prepared to take this kind of teaching upon themselves also. Therefore the training colleges must be converted into cooking and sewing schools, or into carpenters' and bookbinders' workshops!

* * * * * *

The movement to introduce juvenile sports into the German schools is making a good deal of headway. At the last meeting of the association formed with that object, which took place at Görlitz, a number of prizes were offered for the best essays on various aspects of the question. Several large schools have already introduced football and cricket, with other varieties of games known in Germany as *grenzball*, *stossball*, *raffball*, and *feldball*. But it will probably be a long time before any of these games attain the popularity of the English games, for the simple reason that a good turf is extremely rare in Germany. The climate is against it.

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The *Educational Review* of Madras quotes some interesting particulars from the Report on Public Instruction in Burma for 1897–98. The Government complains of want of co-operation between the subordinate inspectors of schools and the executive officers. The commissioners say that the deputy inspectors avoid them and keep them in ignorance of their proceedings. But, on the other hand, the *pongyis* are becoming less and less of an obstacle to the spread of rational education. The improvement in this respect is shown by the attendance of *pongyis* at the Teachers' Conference at Prome, the interest shown by them in the *Patamabyan* examinations, and the efforts made by several of them to qualify for a higher class of teaching by passing the provincial standards and the teachers' examinations. As the *pongyi Kyaungs* must for many years continue to form the majority of the primary schools of the province, the importance of progress in this direction cannot be over-estimated. Burma even aspires to the possession of a university.

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The Adelaide Teachers' Association was recently favoured with a most interesting and instructive lecture by Dr. Eitel, late Inspector of Schools at Hong-Kong. He said the Chinese system of education had been founded many centuries ago, and had made no advance in its methods or its curriculum since its initiation, yet it had been wonderfully successful in diffusing a general knowledge of Chinese literature amongst all classes. While its main object was to train good citizens and state officials, it had never received any pecuniary assistance from Government, the teachers being entirely supported by the fees paid by the pupils. The Chinese teachers were much happier than their Western brethren, as they had no trouble with discipline, and had only about thirty pupils each. The pupils provided their own desks, books, and school material. The object of teaching was to sink individuality, to kill originality, and to elevate the family and the government. The pupils developed wonderful memories and powers of imitation, as the formidable alphabet, consisting of about forty-four thousand word pictures, had to be attacked. Religious teaching was avoided, and there were no schools for girls, who were considered altogether inferior beings.

TECHNICAL AND SECONDARY EDUCATION.

SECONDARY and Technical Education questions have been more than usually to the fore this month. First, there is the question of the statutory right of School Boards to give secondary education in day schools; then there is the manifesto of the Northern Counties Education League; next we have the almost simultaneous publication of the two schemes for commercial education by the London Chamber of Commerce and the Technical Education Board of the London County Council; and lastly, we have the two recent utterances of the Duke of Devonshire on the Secondary Education Bill, which indicate that all things are now ready and the Government are prepared to introduce their Bill as soon as the exigencies of public business allow. Altogether there is copy enough and to spare to fill the pages of a whole PRACTICAL TEACHER with these topics alone.

To begin with that which is perhaps the most burning, if not the most important, question—the right of School Boards to give secondary education in day schools. The whole matter has arisen in a most unexpected fashion. The London School Board were appealing before South Kensington against the demand of the London County Council to be made the authority for science and art education in London, when suddenly Sir John Donelly dropped this bomb into their midst by inquiring, "By what right do ye these things?" or, in other words, what right have you to spend money out of the rates on education in day schools beyond the regulations of the Education Department Code? The School Board reply seems to be, that so long as they give an elementary education to a majority of scholars in any public elementary school, they can give as high and varied an education as they please to the minority. To this it is retorted, that on this interpretation they could give out of the rates, not only higher-grade education, but technical and even university instruction to a minority of, say, 99 out of 200 in any school. If such is the meaning of the Act, then there was no need for the Technical Instruction Acts

or for the Bill to organise and subsidise secondary education, but School Boards would have unlimited power to gradually free the whole education of England at the ratepayers' expense. This is, of course, only a *reductio ad absurdum* of the Board School argument, but it is none the less the logical outcome of it. Furthermore, on comparing passages in the 1870 Act, we find that every school under a School Board must be so conducted as to earn a Parliamentary grant under the Code; and further, the Education Department have laid down "that no child can be considered as a scholar in a public elementary school who is not on the register of the school and is not receiving instruction in one of the seven standards." *De jure*, then, the School Board do not seem to have much in their favour; *de facto*, they have behind them the force of *faits accomplis*. As a well-known member of the London School Board has said, parodying Voltaire on the existence of the Deity, "If no statutory right exists, then it would be necessary to invent it." The only alternative to this is to adopt Mr. Evelyn Cecil's suggestion, and transfer to local authorities the higher work of the School Board, whose "primary object," as the Duke said on the ninth of March, "is to supply elementary education, and when other provision was made by the State and local authorities, it could not be considered the proper duty of School Boards to enter into competition with other authorities in providing secondary or technical education."

Should any attempt, however, be made either by the obscurantist enemies of education or the economy-at-any-price party to cut down the present expenditure on education, it must be steadily resisted. The whole question is one rather of local authority, and what has been done, if it was illegal, must be legalised. The School Boards are undoubtedly more sinned against than sinning, and one would feel more sympathy with them at the present crisis if many of their members in their public utterances had not so persistently ignored the claims of other agencies occupied in giving the major part of the secondary education of this country.

This School Board question of secondary education will probably be first a matter for the law courts, and then for legislation. But until a judicial decision has been obtained, it will be impracticable to attempt to legislate; and the whole question of local authorities for secondary education must therefore be inevitably postponed, since who is to decide the exact quota of School Board representation on the new authority, in the present uncertainty that envelops the School Board's claim?

The friends of the School Board have not been idle. The manifesto of the Northern Counties League dwells on the interconnection between primary and secondary education. They rightly insist on the point that the local requirements of each district should be considered; but on the subject of local areas they do not seem to us to be so sound, as they object to the county being taken as one of the areas for local authorities—a point, however, we need not discuss at present, as the question of local authorities is hung up, as we have already shown, by the School Board question. Frankly, it is also difficult to understand how Clause 7 adds to the "number of existing independent authorities." Such County Council and Technical Education Committees as have been recognised were already in existence. A good point is their protest against the maintenance of the Charity Commission in their present form, as well as against the "rose-water" reforms of the same body proposed in the duke's Bill of last year. The other points raised in the manifesto are naturally shelved by the School Board question to which we have alluded. Though one may not agree with many statements of the League, one is glad to recognise they are as keen as any one to maintain the standard of education already attained in the north. To the outsider, who looks on education from the natural point of view, it is not so much a question of maintaining the inviolability of the Charity Commission or of the School Boards, as of seeing the central and local authority rendered as simple and efficient as possible for carrying on the education of the nation. Principles are deeper than mere authorities, for they underlie them and are their very *raison d'être*; and the principles to be regarded above all to-day are the question of extending and levelling up the average of national intelligence, and of equalisation of opportunity for all. School Boards, Education Departments, Technical Committees, and, as far as education is concerned, County Councils, exist only as means to these two great ends.

We have not left ourselves too much space to discuss the two schemes for commercial education by the Technical Committee of the London County Council and the London Chamber of Commerce. It does not seem quite a matter of pure coincidence that the two have been promulgated almost simultaneously. However, they can both be very well welded into an harmonious whole—in fact, no scheme can be satisfactory that does not enlist the sympathy and support of all those interested in the question, whether merchants or schoolmasters. Both schemes recognise that commerce must be broken up into grades and groups. Taking the Technical Education Board scheme as the fuller and more complete of the two, we find that the necessity is recognised of creating higher-grade schools or departments for those entering business at fourteen; then secondary schools are again divided into two grades—the first for those who enter business at sixteen, for whom a moderate specialisation is proposed in their last year, the same applying (only more so) to those who leave at nineteen. Commercial education of a university type is to be provided for those at the top of the tree, and apparently the London School of Economics is to be widened and enlarged for this purpose. What is especially noteworthy in the two schemes is the desire to make full use of existing institutions. This is more likely to produce satisfactory results than any attempt to start *de novo*. Especially satisfactory, too, is the stress laid on the need of improving our evening continuation classes for those who desire "to rise from the ranks"—the future Dick Whittingtons, as Mr. Yoxall would call them.

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OUR CLASS-ROOM AIDS

LESSON ON THE EYE.

BY ARTHUR NEWSHOLME, M.D., F.R.C.P. (LOND.),

Examiner in State Medicine to the University of London, and in Preventive Medicine to the University of Oxford; Medical Officer of Health of Brighton.

(*See Physiological Diagram presented with this Number.*)

THE teacher who makes all the use of the beautiful large diagram accompanying this issue of THE PRACTICAL TEACHER which it is capable of furnishing, will be able to impart a very clear idea of the anatomy of the eye and the physiology of vision to his pupils.

Diagram A shows a front view of the eye. The eye itself is protected by the two eyelids, which, by their instantaneous contraction when injury is possible, protect the "apple of the eye." This is a striking illustration of *reflex action*—the eye conveying the afferent impulses, the brain interpreting them, and transmitting efferent impulses to the nerves which govern the movements of the muscles of the eyelids and ensure their immediate contraction. The *sclerotic* or white part of the ball of the eye, and the *cornea* or transparent part, are next seen. Within the cornea is seen the *iris*, a muscular diaphragm, which gives the characteristic colour to each person's eye. The contraction of this muscle with increase of light, and relaxation in dim light, cause the diminution and increase in size of the *pupil*, the circular opening bounded by the iris. These movements are further illustrations of reflex action. The co-ordinate action of the two pupils can be shown by getting a person to look at your finger and then gradually bringing the finger closer to his face, when the pupils will steadily contract. The pupil is not circular in all animals. Thus, in Diagram H are seen the oval iris and transverse pupil of the deer; the horned viper (Diagram I) has a round iris and perpendicular pupil.

The eyeball is kept moderately moist, so that it can move in every direction without friction, by the secretion from the *lachrymal gland* (Diagram D). This secretion, more commonly known as tears, is poured by short ducts on to the conjunctival membrane covering the eyeball. Under ordinary circumstances its amount is small. After washing the surface of the eye, it passes through two minute ducts (see Diagram D) into the nasal duct, and helps to form the nasal secretion. The secretion of tears is capable of being greatly increased by mechanical irritation, as by a particle of grit in the eye, or by emotion; hence the vigorous blowing of the nose which commonly takes the place, in men, of weeping in women.

This is not the only mechanism for maintaining the healthy condition of the eye. The eyelids are fringed by eyelashes, and Diagram E shows that on the inner side of the eyelids are numerous minute *meibomian glands*. These secrete a lubricating oily matter, which prevents any stickiness of the eyelids during sleep, etc.

Before passing to the internal structure of the eye, we may consider the means by which its movements in every direction are effected. If a normal scholar is watched reading, the movements of the eyeball from side to side can be seen. One eye turns towards the nose, while the other turns from the nose. This is done by the *external rectus* muscle of one eye co-operating with the *internal rectus* muscle of the opposite eye.

It may be mentioned in passing that a classification of pupils into normal and abnormal, and even into intelligent and stupid, may be made in accordance with whether they move the head from side to side in reading, *or only the eyes*. In looking downwards the two *inferior rectus* muscles act together, and in looking upwards the two *superior rectus* muscles; while in more complex movements the *oblique* muscles come into operation.

In Diagram C these different muscles are seen in a longitudinal section of the eyeball in its socket, and the mode of attachment of the muscles to different parts of the orbit is displayed.

Diagram B shows a vertical section through the eye from front to back. Taking its parts from the front backwards in the central transparent portion of the eye, we come first to the *cornea*. This thin membrane is kept in its bulging position by the *aqueous humour*, near the middle of which is suspended the iris, which has attachments all round near the edge of the *sclerotic*. Behind the aqueous humour is the *lens* of the eye, composed of comparatively dense but transparent material, in the shape of a double convex lens, and forming a strong magnifying-glass. The lens is connected by its capsule at the margin to certain muscular fibres, by the contraction of which the lens can be rendered more or less taut, when it alters its shape. If it becomes more convex, the rays of light are brought sooner to a focus; when less convex—that is, when it is in a passive condition, as for distant vision—the rays of light come to a focus on the retina without effort. In myopic or near-sighted persons the eye is too long from before backwards. Consequently the lens is made to contract excessively, so as to prevent the rays of light from coming to a focus before they reach the retina. Thus the eyes become excessively fatigued, and concave spectacles are required. In presbyopic or old-sighted persons the lens has lost some of its elasticity, and convex spectacles are required to aid the eye. In cataract the lens of the eye becomes opaque like milk.

Behind the lens is the *vitreous humour*, which forms the main bulk of the eye. It keeps in its place on the inner surface of the eyeball the *retina*, the most essential part of the organ of vision.

The *retina* is formed by the minute endings, specially differentiated, of the *optic nerve*, which has entered the eyeball at its back, and which, as will be seen from Diagram F, connects the eye with the brain. Objects are not seen by the eye. The eye simply receives and conveys the rays of light to the retina, along the fibres of which they are conveyed by the optic nerve to the brain, which is really the organ of vision, as it alone can interpret the impressions conveyed by the eye. The view of the under side of the brain shown in Diagram F shows that the two optic nerves intercommunicate to some extent before becoming part of the brain, which has important bearings on the physiology of vision.

Returning to Diagram B, it will be noticed that outside the retina, and between it and the sclerotic, is a black membrane called the *choroid*. Were it not for this black membrane, which absorbs superfluous and excessive rays of light, accurate vision would be out of the question, as we see in albinos, in whom this membrane is deficient in black pigment.

For further particulars about the different parts of the eye, which space does not permit of our giving here, reference should be made to any standard work on physiology.

One Hundred Short Essays in Outlines. Professor Meiklejohn's Series. (A. M. Holden.) This is undoubtedly one of the most useful books for pupil teachers, scholarship and certificate students, ever produced. It is a natural sequel to the recently-published *Art of Writing English*, by the same author, and affords a solution to the two chief difficulties experienced in writing essays—first, the insufficient knowledge of the subject; and secondly, the lack of coherent and logical arrangement of what is known. The selection and tabulation of the facts given are excellent, and it would be difficult to find a topic which has not a type in these models. We cannot too strongly recommend all students to obtain and use this book, for it is simply excellent.

Certificate 1899.

VOYAGE AUTOUR DE MA CHAMBRE.

(XAVIER DE MAISTRE.)

With Introduction, Notes, Exercises, etc.

By GEORGE COLLAR, B.A., B.Sc.,

HEAD-MASTER OF STOCKWELL PUPIL-TEACHERS' CENTRE.

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(See Physiological Diagram presented with this Number.)

THE teacher who makes all the use of the beautiful large diagram accompanying this issue of THE PRACTICAL TEACHER which it is capable of furnishing, will be able to impart a very clear idea of the anatomy of the eye and the physiology of vision to his pupils.

Diagram A shows a front view of the eye. The eye itself is protected by the two eyelids, which, by their instantaneous contraction when injury is possible, protect the "apple of the eye." This is a striking illustration of *reflex action*—the eye conveying the afferent impulses, the brain interpreting them, and transmitting efferent impulses to the nerves which govern the movements of the muscles of the eyelids and ensure their immediate contraction. The *sclerotic* or white part of the ball of the eye, and the *cornea* or transparent part, are next seen. Within the cornea is seen the *iris*, a muscular diaphragm, which gives the characteristic colour to each person's eye. The contraction of this muscle with increase of light, and relaxation in dim light, cause the diminution and increase in size of the *pupil*, the circular opening bounded by the iris. These movements are further illustrations of reflex action. The co-ordinate action of the two pupils can be shown by getting a person to look at your finger and then gradually bringing the finger closer to his face, when the pupils will steadily contract. The pupil is not circular in all animals. Thus, in Diagram H are seen the oval iris and transverse pupil of the deer; the horned viper (Diagram I) has a round iris and perpendicular pupil.

The eyeball is kept moderately moist, so that it can move in every direction without friction, by the secretion from the *lachrymal gland* (Diagram D). This secretion, more commonly known as tears, is poured by short ducts on to the conjunctival membrane covering the eyeball. Under ordinary circumstances its amount is small. After washing the surface of the eye, it passes through two minute ducts (see Diagram D) into the nasal duct, and helps to form the nasal secretion. The secretion of tears is capable of being greatly increased by mechanical irritation, as by a particle of grit in the eye, or by emotion; hence the vigorous blowing of the nose which commonly takes the place, in men, of weeping in women.

This is not the only mechanism for maintaining the healthy condition of the eye. The eyelids are fringed by eyelashes, and Diagram E shows that on the inner side of the eyelids are numerous minute *meibomian glands*. These secrete a lubricating oily matter, which prevents any stickiness of the eyelids during sleep, etc.

Before passing to the internal structure of the eye, we may consider the means by which its movements in every direction are effected. If a normal scholar is watched reading, the movements of the eyeball from side to side can be seen. One eye turns towards the nose, while the other turns from the nose. This is done by the *external rectus* muscle of one eye co-operating with the *internal rectus* muscle of the opposite eye.

It may be mentioned in passing that a classification of pupils into normal and abnormal, and even into intelligent and stupid, may be made in accordance with whether they move the head from side to side in reading, *or only the eyes*. In looking downwards the two *inferior rectus* muscles act together, and in looking upwards the two *superior rectus* muscles; while in more complex movements the *oblique* muscles come into operation.

In Diagram C these different muscles are seen in a longitudinal section of the eyeball in its socket, and the mode of attachment of the muscles to different parts of the orbit is displayed.

Diagram B shows a vertical section through the eye from front to back. Taking its parts from the front backwards in the central transparent portion of the eye, we come first to the *cornea*. This thin membrane is kept in its bulging position by the *aqueous humour*, near the middle of which is suspended the iris, which has attachments all round near the edge of the *sclerotic*. Behind the aqueous humour is the *lens* of the eye, composed of comparatively dense but transparent material, in the shape of a double convex lens, and forming a strong magnifying-glass. The lens is connected by its capsule at the margin to certain muscular fibres, by the contraction of which the lens can be rendered more or less taut, when it alters its shape. If it becomes more convex, the rays of light are brought sooner to a focus; when less convex—that is, when it is in a passive condition, as for distant vision—the rays of light come to a focus on the retina without effort. In myopic or near-sighted persons the eye is too long from before backwards. Consequently the lens is made to contract excessively, so as to prevent the rays of light from coming to a focus before they reach the retina. Thus the eyes become excessively fatigued, and concave spectacles are required. In presbyopic or old-sighted persons the lens has lost some of its elasticity, and convex spectacles are required to aid the eye. In cataract the lens of the eye becomes opaque like milk.

Behind the lens is the *vitreous humour*, which forms the main bulk of the eye. It keeps in its place on the inner surface of the eyeball the *retina*, the most essential part of the organ of vision.

The *retina* is formed by the minute endings, specially differentiated, of the *optic nerve*, which has entered the eyeball at its back, and which, as will be seen from Diagram F, connects the eye with the brain. Objects are not seen by the eye. The eye simply receives and conveys the rays of light to the retina, along the fibres of which they are conveyed by the optic nerve to the brain, which is really the organ of vision, as it alone can interpret the impressions conveyed by the eye. The view of the under side of the brain shown in Diagram F shows that the two optic nerves intercommunicate to some extent before becoming part of the brain, which has important bearings on the physiology of vision.

Returning to Diagram B, it will be noticed that outside the retina, and between it and the sclerotic, is a black membrane called the *choroid*. Were it not for this black membrane, which absorbs superfluous and excessive rays of light, accurate vision would be out of the question, as we see in albinos, in whom this membrane is deficient in black pigment.

For further particulars about the different parts of the eye, which space does not permit of our giving here, reference should be made to any standard work on physiology.

One Hundred Short Essays in Outlines. Professor Meiklejohn's Series. (A. M. Holden.) This is undoubtedly one of the most useful books for pupil teachers, scholarship and certificate students, ever produced. It is a natural sequel to the recently-published *Art of Writing English*, by the same author, and affords a solution to the two chief difficulties experienced in writing essays—first, the insufficient knowledge of the subject; and secondly, the lack of coherent and logical arrangement of what is known. The selection and tabulation of the facts given are excellent, and it would be difficult to find a topic which has not a type in these models. We cannot too strongly recommend all students to obtain and use this book, for it is simply excellent.

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VOYAGE AUTOUR DE MA CHAMBRE.

(XAVIER DE MAISTRE.)

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HEAD-MASTER OF STOCKWELL PUPIL-TEACHERS' CENTRE.

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NOTES OF TWO LESSONS.

By WILLIAM DONE, B.A., *Head-Master of Brighton Pupil Teachers' School.*

(Circular 369—Scheme III. (*a*).)

I.—THE MOON.

HEADS.	MATTER AND METHOD.
I. We never see more than one side of the Moon.	Place a ball upon the table to represent the earth. Take a smaller one to represent the moon. Chalk over one-half of its surface. Move the small ball completely round the larger one, always presenting its full chalked face to the other. If the class watches attentively, or if a child repeats what you have done, the conclusion will be arrived at that the smaller ball has made two movements—it has travelled round the larger one, and has also made a complete rotation on itself.
	Refer to the moon. When it is full, we always see the same markings on its surface, making up what is generally called the figure of the old man in the moon.
II. The Moon has no light of its own; it shines by reflected light.	The moon itself is a dark body. Like the earth, it gets its light from the sun; so we say that it shines by reflected light.
III. Phases of the Moon.	During the month preceding the lesson, ask individual scholars to draw the shape of the illuminated part of the moon at intervals of two or three days. Collect these drawings, and sketch on the blackboard the shapes of full moon, quarter, crescent, gibbous moon.
	Fix up on the end wall of the class-room a large, yellow, circular piece of paper to represent the sun. Stand a child in the middle of the room to represent an observer on the earth. Take the ball used for the moon in the previous experiment, and move it slowly in a large circle round the boy, with the whitened or illuminated half always directed to the sun.
	As the experiment proceeds, draw the corresponding diagram on the blackboard.
	When the ball is between the boy and the yellow disc, no portion of the illuminated half is seen. This corresponds to the position of the real moon when none of its surface is visible to a person in a similar position on the earth's surface. Move the ball a quarter round the circle. The lines joining the boy to the yellow disc and the ball now form a right angle, and the boy sees a half of the illuminated portion—that is, a quarter of the whole surface. Proceed similarly to obtain the other appearances of the moon, and fill in the diagram on the blackboard.
	From the drawings brought in by the class we gather that from new moon to first quarter takes practically a week, from thence to full moon again a week, and so on.
	During this time the moon is said to be *waxing*; now it commences to *wane*.
	The moon thus takes just about a month to make a complete journey round the earth. In olden times the months were measured by the moon's passage. The word moon means "measurer."

II.—THE PLANETS.

HEADS.	MATTER AND METHOD.
I. Venus, the Evening Star.	The appearance of the solitary luminous body called the Evening Star will be familiar to some of the class. For several successive evenings when it is visible, let some of the children note its position in the heavens, and also the facts—(*a*) that it comes into view just after sunset; (*b*) that next to the sun and moon it is the brightest of the heavenly bodies, and (*c*) that it shines with a steady light. It soon sets or disappears. When in the opposite part of its orbit, it rises just before sunrise, and is then called the Morning Star.
II. Stars and Planets.	In a previous lesson, on star groups or constellations, the children understood that stars always keep the same *relative* position. Now, by marking on paper the relative position of Venus and other stars, it is found that she *changes her place* amongst them. She is not a star at all, but is called a *planet*, from the Greek word *planetes*, "a wanderer." Compare with the movements of our earth.
	Planets are heavenly bodies which revolve probably round all stars, and receive their light from them; but we can see only those that revolve round the sun.
III. Names of the Planets which revolve round our Star—the Sun.	The star nearest to us is called the Sun, and the planet revolving round it most interesting to us is the Earth. Others are—Mercury, Venus, Mars, Jupiter, Saturn, Uranus, and Neptune.
	Some of these planets have moons revolving round them, and the whole group of sun, planets, and moons makes up what is called the *Solar System*.
IV. Relative sizes of the Planets.	If a circle made by tracing round a penny represents Jupiter, that made by a halfpenny will represent Saturn; Uranus and Neptune will be about the diameter of a threepenny piece, Venus and the Earth about the diameter of a large pea, while Mars and Mercury will be mere dots.
V. Planets also rotate on their axes.	Refer to the two motions of the earth. All planets, as far as we know, rotate on their axes, as well as revolve round the sun in elliptical orbits.
VI. Relative distances of the Planets from the Sun.	The actual distances of the planets from the sun are in such large numbers as to have no meaning to the children, but the relative distances according to Bode's Law might advantageously be given.
	Let 4 represent the distance of Mercury from the sun; then the other distances in order are 10, 16, 52, 100, 196.
	If these figures are estimated in inches, they might be chalked on the class-room floor.
VII. Superior and Inferior Planets.	Mercury and Venus, coming between the earth and the sun, are called Inferior Planets (Latin *inferus*, "that which is below"), while those beyond our earth are called Superior Planets.

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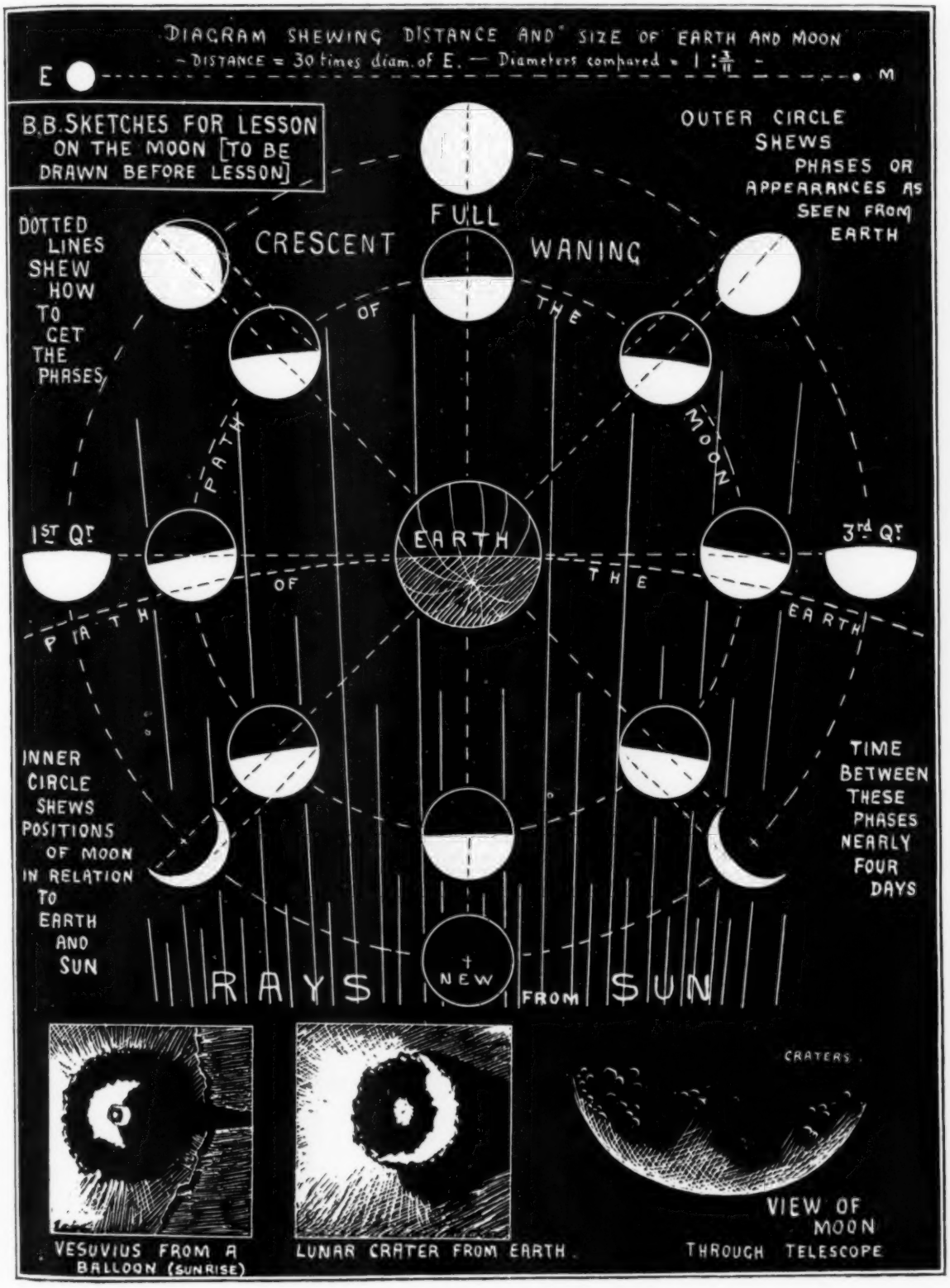
BLACKBOARD ILLUSTRATION.

BY C. ARMSTRONG, ART MASTER, CITY OF LONDON SCHOOL OF ART, EXAMINER TO DEPARTMENT OF SCIENCE AND ART.



THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

Reading the Important Subject. **Reading** is the most important subject of the school curriculum. Plenty of time must be allowed for it, even in infant schools. Give the first class infants from four to five hours per week. In the lower standards you should allow four hours, and in the upper standards not less than three hours. Have a good reading lesson every morning. Never place a reading lesson at the end of the day.

* * * * * *

Reading in Infant Schools. Reading in infant schools should be taught mainly from the blackboard and through word-building. Books should only be used occasionally in the first class, to accustom them to their use before proceeding into the mixed department. The course of word-building must be carefully arranged and systematically followed, and the reading lessons should follow naturally the word-building course. There is one drawback to blackboard reading—the children deal with words, and get little or no practice in phrasing and sentence-reading. Therefore I would supplement with books towards the end of the year in the sixes' class. The matter for reading lessons can often be got from the children by questioning them, or the object lessons might be used as material for reading lessons. In infant schools there is too frequent a tendency to allow the class to answer in the mass. Individual work is more reliable, though slower. Babies should do nothing except pick out the letters, learn their names and sounds, and make them in sand.

* * * * * *

Reading for Elder Children. In the upper schools reading becomes a much more serious business. Reading books are now a *sine qua non*. A few general hints may therefore be suitably mentioned here:—

1. Teach the children how to handle the book for themselves. Even Standard I. should know the use of the index.

2. In choosing readers, avoid those which are merely geographical or historical text-books. Books with some humble attempt at literary finish should be preferred.

3. Do not confine the reading to two or three books. When the set books have been read, introduce others; the more variety the better. For the lower standards especially, be careful to choose books well illustrated.

* * * * * *

A few General Notes on the Subject. The great object of reading should be borne in mind in all reading lessons—namely, to obtain knowledge. A proper lesson would be one where the teacher commenced by telling the children briefly the substance of the chapter. This should be followed by pattern-reading. Individuals then read, and are corrected by the teacher. With regard to meanings, it is not always advisable to explain a word the first time it occurs, as very often a child can arrive at its meaning himself after he has met with it twice or thrice. He will then be more likely to remember it. Again, avoid giving alternative words as explanations. Where possible, let a little paraphrase of a sentence including the difficult word be given. For this reason, it is much more useful to ask for the meanings of short passages rather than of single words. Explanation of meanings should not come before the reading lesson.

The teacher should always have a blackboard at hand to note down the difficulties of the lesson. If the geographical or historical reader is being used, the map should also be at hand, and all places named should be pointed out thereon. Care, however, should be taken not to make the reading lesson subservient to one of the class subjects. Too often do I find that geography is taught through the reading lessons. This is radically wrong, since the aim in the two lessons is quite distinct. In the reading lesson we wish to instil a love for reading, and cultivate a taste for the same.

* * * * * *

Some Special Points for consideration. There are four or five points that need special attention in teaching this subject:—1. Expression; 2. Pronunciation; 3. Phrasing; 4. Intelligence. In rural districts monotonous reading is very common, and teachers have told me it is exceedingly difficult to produce expression. Pattern-reading is very helpful. The recitation and singing lessons should be made use of to help here, as it is the voice modulation that is at fault. Pronunciation should not cause so much trouble. Be careful to watch provincialisms both in speech and reading, and look after final *d*, *t*, *ng*. The aspirate is receiving much more attention, though it is not yet produced naturally. To the proper phrasing of the words much is due. Excellent reading cannot be obtained without this. Train the children to let the eye precede the voice, and to look off their books as they read each phrase. This will make them deliberate. Lastly, it is highly important that the children should understand what they read. Therefore, they should be questioned at the end of the lesson upon the subject-matter of what they have been reading. To read with intelligence, the listener should understand as well as the reader. Counsel your scholars to read as they would talk.

* * * * * *

Silent Reading for Elder Children. Silent reading is very useful, especially for the upper standards. If the younger scholars have been well trained, they will make good use of the silent lessons. Indeed, generally the elder children should be allowed time to themselves. In rural schools where the teacher has several standards on her hands, she will find it very useful to set Standards IV., V., VI. to read quietly whilst the lower standards are reading aloud. At the end of the lesson, of course, you question them, to ascertain that the time has been well spent. And here I may say that, as well as the readers, in the upper standards I should use newspapers and magazines. Then you should encourage them by getting together a library and lending them books to read at home. Each scholar in the upper standards should possess a small dictionary, and should look up during his silent reading lesson the meanings of the hard words. It is also advisable to arrange for scholars to read at some distance from the class. It gives them confidence, and inculcates clearness and deliberation.

* * * * * *

Attendance at a Free Library. Some attempts have been made to connect elementary schools with the free libraries in certain towns. Mr. John Ogle of Bootle has prepared a valuable report on this subject. In some towns, he says, school libraries are kept at the public library. In other towns facilities are offered for class reference work and for library lessons. In America, according to Mr. Ogle, much more use is made of the class reference system. In Cardiff, so it is reported, the Education Department has permitted an adjustment of the time-table allowing of visits to the libraries during school hours. After all, this is simply an extension of the liberty already in practice as far as museums and swimming baths are concerned.

* * * * * *

ANSWERS TO CORRESPONDENTS.

J.B.—You must sit again in December. After you have done so, write to me again, giving me the result, and I will then give you the advice you need.

T.M.J.—Are your dates correct? You can sit for Part II. if you did not sit in 1898. The rule is that, having sat the second time, you cannot sit again in the succeeding year.

C.J.D.—See Article 47 (ii.) of the Scotch Code. Unless there has been a recent alteration, you can do so.

J.A.M.—*Manuals in Agriculture*, by Professor Tanner, published by Macmillan; *Hygiene* (Nutter and Firth's), published by Longman. You must take elementary first.

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OUR NEWSPAPER NOTEBOOK.

THE RIVAL CANALS.

COLUMBUS, groping his way across the Atlantic in search of a passage to the East Indies, stumbled on Central America. Ever since that time the value of a waterway to directly connect the Atlantic and Pacific Oceans has been discussed by maritime nations.

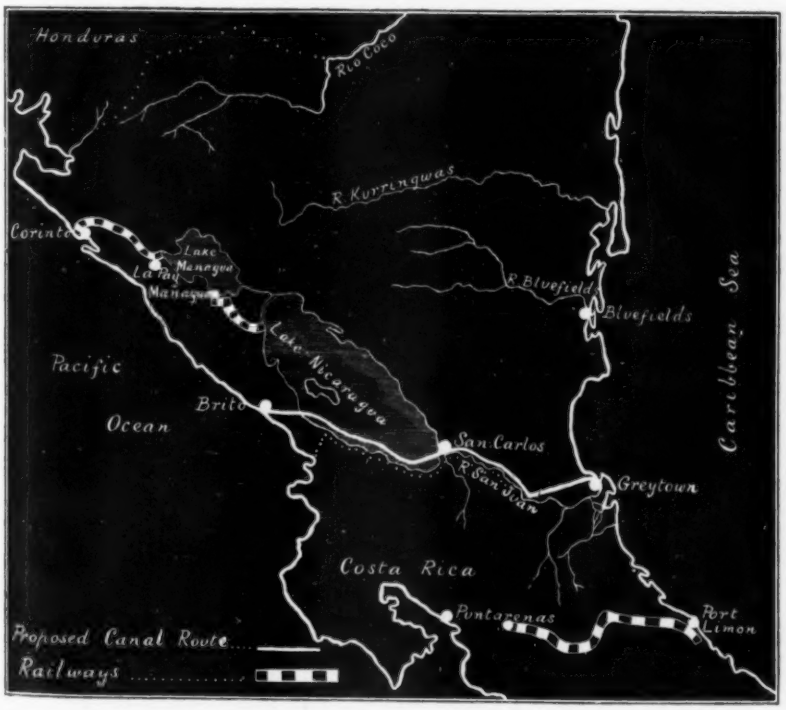
The distance from London or Liverpool to Auckland (New Zealand) is 12,670 miles *viâ* the Suez Canal, 14,380 miles *viâ* the Cape of Good Hope, 11,350 miles *viâ* Central America; and if a canal were an accomplished fact, English vessels trading to the western ports of America would save from two to six thousand miles. It is evident that an inter-oceanic canal across Central America would be a distinct acquisition to the world's great commercial waterways, but the best route for the canal to traverse is a matter of divided opinion and considerable uncertainty.

In 1881 Ferdinand de Lesseps commenced the construction of the Panama Canal—a scheme which ended in failure, and entailed great financial loss to all connected with the unfortunate undertaking.

It is now proposed to construct a waterway across Nicaragua, and there seems every probability that this will be the route eventually selected by the United States, under whose ægis the canal will be constructed.

Nicaragua Canal.—The sketch-map will show at a glance the proposed route, and also the extent to which the natural features of the country lend themselves to the scheme.

The total length of the Nicaraguan route will be 170 miles



from ocean to ocean, of which 68 miles are in the San Juan River, and 56 miles in Lake Nicaragua.

The San Juan, though a tropical river, is peculiar in that it is exempt from floods, which is unusual in similar surroundings. The summit level to be overcome does not exceed 110 feet, and the locks to compass this probably present no greater difficulties than enormous expenditure in construction. A navigable channel can easily be dredged off the south-eastern shore of the lake.

The harbours at Brito and Greytown are bad, at the latter place notoriously so, and good harbours would have to be constructed. The passage of the whole length of the canal would be about forty-four hours.

The estimated cost of construction is £16,000,000, and the United States would consider it not an exorbitant price to pay for the advantages it would undoubtedly give them in the markets of China, Japan, and Australasia, leaving questions of naval strategy out of consideration.

Panama Canal.—In 1879 an international congress met in Paris to discuss De Lesseps' plan of cutting through the isthmus. The Panama Canal Company was formed, and operations were commenced. In 1888 the canal was to be ready for opening. Immense sums of money were required year after year, until the company was forced into liquidation in 1889. Investigation revealed mismanagement and gross corruption; prosecutions followed, Lesseps and his son and others were imprisoned, and the French Republic was shaken to its very foundations.

A newly-formed company is still slowly extending the canal, which is now about two-fifths completed; the difficulties ahead have been accurately gauged, and the cost carefully estimated at about one-sixth less than that of the Nicaraguan route. The total length would not exceed forty-six miles, and the passage would occupy about fourteen hours. The entrance ports, Aspinwall and Panama, have good harbours, and the towns are connected by rail.

In some quarters it is thought the French Panama Company is now again pushing ahead with the work simply in the hope that the United States will purchase the undertaking for themselves. It is very certain it would be cheaper to do this than to take up an entirely new scheme.

The Panama Canal certainly appears to possess many physical advantages, but political considerations may outweigh them. Whichever route comes to the fore, the great commercial nations of Europe, and particularly Britain, will be vitally interested in its success.

RAVAGES OF THE SEA.

The ever-restless ocean is constantly effecting slow changes in our coast-line, and nowhere perhaps are these so marked as along the coast of Suffolk. Dunwich, once the capital of East Anglia, was formerly a city of considerable commercial importance, among its buildings being no less than eight parish churches. Henry the Third made a grant of £200 towards checking the encroachment of the sea. The destruction, however, has gone on unceasingly, and Dunwich is now a little coast village of two hundred and thirteen inhabitants.

Aldeburgh has suffered very much the same fate. As late as 1559 it was of considerable size; its population is now only about two thousand, and likely to decrease, for even within the present century many houses, the market-place, and the cross have been swallowed up.

At Southwold it is calculated the sea has gained on the land about one and a quarter miles since 1100. Notwithstanding the erection of sea-walls and other defence works, quite half an acre of land has disappeared within the last few years.

These places appear to be doomed, and it may be that tradition will say of them as it has of Büsen on the Holstein coast,—

> "At times, when the low water falls,
> The sailor sees the ruined walls;
> The church tower peeps from out the sand,
> Like to the finger of a hand.
> Then hears one low the church bells ringing,
> Then hears one low the sexton singing."

COCOA-NUTS.

The cocoa-nut tree is a species of palm that must not be confounded with the cocoa or cacao tree. It flourishes without cultivation in tropical countries, as Southern India, Ceylon, the Straits, West Indies, etc. A native of these places with a dozen cocoa-nut trees in his garden is in a state of comparative affluence; for the tree not only affords the materials for his house and domestic utensils, but supplies his meat and drink as well.

The English trade in cocoa-nuts (called also coco and coker nuts) is in a very few hands. The nuts are usually carried by small sailing vessels, whose cargoes vary from 200,000 to 500,000 nuts each. As little as £3 will purchase a thousand; but should they happen to still be in their husks, the price will be about £1 more, for the husk fibre is valuable for matting, rope, etc.

The nut trade is not an increasing one, for the production of cocoa-nut oil is far more profitable. The sun-dried fruity part of the nut is called copra, and from this the oil is extracted by pressure. Cocoa-nut oil is worth from £20 to £30 per ton, and is largely used in the manufacture of soap.

THE CLIMATE OF THE CONGO FREE STATE.

Mr. Pickersgill's consular report warns intending emigrants that no one should contemplate an excursion to the Congo unless he be "a well-salted animal, or a man prepared to die." He adds: "It is estimated that of every ten whites who become officers of the state, nine are either buried or invalided within three years; and a calculation was made a short time ago which showed that the employees of the largest Belgian trading company, who number one hundred and twenty, only maintain an average service of seven months out of the twenty-four for which they contract.

"The missionaries suffer somewhat less perhaps, being, as a rule, more careful to avoid unnecessary exposure, and also better provided with the means of combating disease. They fall, however, with startling frequency; and amongst them, as amongst the officials and traders, the word is constantly being passed to close the ranks. A favoured few—two per cent. about—appear to be adapted to the climate in some way or other, and not only survive, but keep strong and well. But for those who are neither lucky as to their constitution, nor reckless as to their fate, life is a perpetual vigil against treacherous fevers, and, when nerves become weakened by the strain, an existence regulated by the clinical thermometer."

A NEW HARBOUR IN THE WHITE SEA.

The Russian naval authorities believe the Baltic harbours of Cronstadt and Libau would be of little use in the event of a strong naval power blockading the narrow entrances to the Baltic between Sweden and Denmark. For many years the Russians hoped Norway could be persuaded to concede them a harbour, but this has now been definitively refused. It has been decided to construct a new naval harbour in Katherine's Gulf, the north-western arm of the White Sea. It is generally supposed this northern sea is ice-bound for several months in the year, but as a matter of fact the waters of Katherine's Gulf are frozen only during exceptionally severe winters.

ELEMENTARY LESSONS IN THE PRINCIPLES OF GRAMMAR.

BY JOHN R. TIMSON, B.A.,
Head-Master, Board Schools, Royston, Barnsley.

LESSON VI.

COMMON AND PROPER NOUNS.

LANGUAGE supposes—

1. A speaker.
2. A hearer.

The speaker—

1. Knows something, the result of using his senses.
2. Tells that something to the hearer.

Speech is the instrument or vehicle used to convey knowledge by a speaker to a hearer.

The hearer—

1. Receives the language of the speaker.
2. Tries to understand it, and to obtain the knowledge the speaker desired to convey.

Hence there are two distinct processes:—

1. Putting knowledge into words.
2. Taking knowledge out of words.

Language may be said to be correct and true when the hearer is able to take from it just what the speaker intended to convey, neither more nor less.

If a man speaks badly, he may still make himself well understood. But the hearer may say to himself, "This man by his speech shows himself to be ignorant and vulgar." In such a case the speaker may have given information which he was most anxious the hearer should not know. We see then how exceedingly important is the study of language, and the practice of speaking correctly. Let us always try by our conversation to show that we desire to be good, kind, and courteous. Our language shows what we are much more than our clothes do. Lord Bacon once pleaded for a miserable prisoner whom Queen Elizabeth was intending to put to the rack. He said, "Madam, do not rack his body, but give him pen, ink, and paper. Rack his thoughts by making him write, and I will tell you whether he is true and loyal." Lord Bacon well knew that a bad man could not deceive a learned judge, but would expose his bad thoughts in the language he used.

The first step to good language is to have good thoughts, to try to lead a good life, and never to think of bad and disgusting things. A man who is lazy and careless in his language may make others think that he will be lazy and careless in his work and conduct. We should then use every endeavour to conquer the difficulties in the way of correct language.

We have called the first-names used to indicate anything "pronouns." Pronouns are used for names, and personal pronouns simply distinguish between the speaker, the hearer, and all besides. The principal are: I, thou, he; we, you, they.

The names given to persons, places, animals, and things are called nouns.

If a noun is the name of every one of the same class or kind, the noun is called a common noun; for example,—

Boy, girl, town, horse, planet.

But for any one we may give a special name; as,—

Thomas, Mary, Royston, Dobbin, Venus.

Each of these names is called a proper noun, because it is the special property of the person or thing named. *Proper* means "one's own."

Proper nouns always begin with a capital letter. Think of all the common nouns by which you may be named—boy, scholar, brother, pupil, cousin, and so on. Then say your own special name—for example, "Thomas Jones"—and you will understand the difference between common nouns and proper nouns.

A common noun is that which is shared in by others. A proper noun is used to indicate one only.

Pronouns may be regarded as the most "common" of all names.

MEMORY NOTES.

Language is the most valuable of all studies, for it is continually betraying our character, our nationality, our knowledge, and our ignorance.

Truth in thought is the only safe foundation for truth in language.

A proper noun is the special name belonging to some person or thing. It is the person's or thing's *own* name, not shared in by another; for example,—

Thomas, Barnsley.

Proper nouns begin with a capital letter.

A common noun is a name used for any of the same kind, shared in alike by all in the same class; for example,—

Scholar, boy, girl.

CASES FOR BINDING Vol. I.

OF THE

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LITERAL.

SCENE II.

JEAN, THE ABBÉ, VÉRONIQUE.

Véronique enters (in) carrying a great soup tureen, which she places on the table.

VÉRONIQUE.

And the soup is served ("up").

JEAN *and the* ABBÉ.

Ah!

VÉRONIQUE, *offering her forehead to the Abbé.*

Dear uncle!...

THE ABBÉ, *embracing (here, kissing) her.*

Good-morning, (my) niece!

VÉRONIQUE, *to* JEAN.

Monsieur Jean,
I have (*lit.* am) surpassed myself to-day...

Raising the lid of the tureen.

Judge of it.

JEAN.

Let-us-see that, darling... Oh! the good puff!

Jean and the Abbé place themselves at ("the") table, and begin to eat. Véronique has her plate[1] laid, and seats herself also, but at each (=every) moment she gets up (lit. *raises herself=rises*) *to serve* (i.e. *wait*).

But you are truly our little fairy,
Véronique, and since (that) you are here,
The mourning of my house already has[2] brightened itself,
So much you spread in-it (*lit.* there, to-it) (the) life and (the) light.

VÉRONIQUE.

Leave ("off") then, Monsieur Jean! I play at the farm-woman
As the poor Queen has done at Trianon,[3]
And I have read Florian; "that's" all.

JEAN.

Ah, well! no.
Watteau[4] would-have-little-taste for my sheep-fold in prose,
Where the sheep have not at-the neck a coloured ribbon:
And in this ruin where I live as a (*lit.* in) farmer
Florian would complain of the smell of-the manure.
No, no, you have not the head so light:
You are a good and clever housekeeper;
And the poor fellow (*lit.* boy, bachelor) who knows that-which (=what) he owes you
Blesses God who has led you under his roof!

VÉRONIQUE, *aside.*

When he speaks to-me thus, how my heart palpitates!

THE ABBÉ, *to Jean.*

And I, (I) shall have at-the (*lit.* of the) least brought the little ("girl");
She will pay-for ("the") two ("for") your hospitality;
For I feel severely (*lit.* hardly) my uselessness,
Dear friends, and I suffer for-it (*lit.* of it) in my nights of sleeplessness...
Good for nothing[5]!...I am not but (=only) a man of genius.

JEAN.

My poor[6] Abbé.

NOTES: **Literal:**—

[1] *Couvert* is what "covers" the table prepared for a meal, and is commonly used where we say "knife and fork."

[2] In future it will be assumed that the student knows that, in French, reflective verbs are conjugated with the verb *être*.

FREE.

SCENE II.

JEAN, THE ABBÉ, VÉRONIQUE.

Véronique enters, carrying a great soup tureen, which she puts on the table.

VÉRONIQUE.

The soup is ready.

JEAN *and the* ABBÉ.

Ah!

VÉRONIQUE, *bending her forehead to the Abbé.*

Dear uncle!

THE ABBÉ, *kissing her.*

Good-morning, niece!

VÉRONIQUE, *to* JEAN.

I really think I have surpassed myself to-day, Monsieur Jean.

Raising the lid of the tureen...

But taste for yourself.

JEAN.

I will, my girl!... The steam smells delicious!

Jean and the Abbé seat themselves at the table, and begin to eat. Véronique also sits down to the table, but at every moment she rises to wait upon the others.

You are really our little fairy, Véronique, and since you have been here, the cloud that overshadowed my house has already been cleared. You spread around it so much life and light.

VÉRONIQUE.

Come, Monsieur Jean! I play at being a farm woman, like the poor Queen at the Trianon. And then, I have read Florian. That's all!

JEAN.

Hardly so! Watteau would have cared little for my prosaic sheep-fold, when the sheep have to do without coloured ribbons at their necks. And as to Florian, he would complain of the smell of manure that pervades the tumble-down house which I occupy as a farmer. No! you are no giddy-head, but a good and clever housekeeper. And the poor fellow, who knows how much he owes you, blesses God for sending you to live under his roof.

VÉRONIQUE, *aside.*

When he speaks to me like that, how my heart beats!

THE ABBÉ, *to Jean.*

And I shall have at least the satisfaction of having brought her here. She will repay the hospitality you have shown to both of us. For I feel only too greatly how useless I am, dear friends; and I think of it when I lie awake at night. Useless!... I am only a man of genius!

JEAN.

Dear good Abbé.

[3] Trianon, a model farm in the park of Versailles, where Marie-Antoinette delighted in playing the part of a peasant woman.

[4] A celebrated French painter of pastoral subjects (1684–1721).

[5] N.B.—*Rien* is literally "thing" (Lat. *rem*). *Bon à rien=Je ne suis bon à rien*, "I am not good for anything."

[6] *Pauvre*, when used thus, often means "dear" or "good."

OUR TUTORIAL SECTION

THE L.L.A. OF ST. ANDREWS.

B.—THE DEPARTMENT OF PHILOSOPHY.

LOGIC AND METAPHYSICS.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
Author of "Mental Science and Logic for Teachers."

BOOKS TO BE STUDIED.

1. Jevons' *Elementary Lessons in Logic*, with Cartwright's *Mental Science and Logic for Teachers.*
2. Mill's *Logic*, Books I., II., with chaps. i.–viii., and xxi. of Book III., and Douglas's *John Stuart Mill.*
3. Ryland's *Psychology*, 7th edition.
4. Fraser's *Selections from Berkeley.*
5. *For reference only*, Minto's *Logic, Inductive and Deductive.*

Mill's "Logic"—(conclusion).

Book III., Chap. i.—It is necessary to establish first of all what a general proposition is, because the establishment of a general proposition is one of Mill's tests of induction. Observe that the predicate is affirmed or denied of an *indefinite number of individuals*, or that it is a proposition in which one phenomenon is always a mark of another phenomenon. Hence, "all continents possess large rivers" is not general, because "large rivers" do not necessarily accompany "continents;" and the same applies to "all the apostles were Jews."

The three things necessary to induction are—(1) **Inference**; (2) **The establishment of a general proposition**; (3) **On the evidence of particular instances.**

Book III., Chap. ii.—In this chapter are given cases of inductions improperly so called—that is, seeming inductions which fall short in respect to one or other of the three essentials given above. These are:—

1. Mere verbal transformations.
2. Mathematical inductions.
3. Parity of reason.
4. Colligation of facts.

Verbal Transformations.—Here the conclusion is simply a summing up of the premises, as in the two examples given above—that is, "continents" and "apostles." These so-called "perfect inductions" are not inductions, because there is no inference, and because the conclusion is not a general proposition, but a mere shorthand registration of facts known, and is no wider than the premises upon which it is founded. In fact, says Mill, the general proposition is so only in name, it being really a string of simple propositions in condensed form.

Mathematical Induction.—Here a general proposition—as, "a straight line cannot cut a conic section in more than two points"—is admitted as the result of the process; which, however, is not allowed to be induction at all, because there is no inference, the conclusion being again merely a summing up of the premises. Other logicians do not agree in this denial. They claim that the conclusion is arrived at by inference from the "exact analysis of conditions," which Mill himself admits to be an inductive process.

Parity of Reasoning, in which (1) a theorem is proved from a diagram, and then inferred to be true universally; (2) in filling up the terms of a series after the ascertainment of the laws governing it. Here Mill again argues that the conclusion is general, but the process is not inference, because the general truth is not believed on the evidence of the particular instances, since it is recognised that the same evidence will suffice to prove every case, on account of the exact similarity of conditions or relations. Here, again, Mill is not to be accepted without much consideration, since it is claimed that to recognise that a general truth applies to all cases because of the exact similarity of all cases is inference, and therefore induction.

Colligation of Facts.—Mill asserts that Whewell's colligation is conception pure and simple; but this does not appear to be at all the case. Rather is it true that colligation is another name for hypothesis, and what Whewell asserted is now accepted by many, if not most, thinkers as true—namely, that in the upward process from particular examples of phenomena to the general laws that include them, the mind is constantly supplying hypotheses which "may supply the true bond of connection of the facts," and so assist in arriving more speedily and more effectually at the generalisation. Of course the hypotheses must be often and carefully compared with the facts of observation, with which they must agree, or be at once rejected. This we said in an earlier article when we quoted Turgot's epigram, "First invent a system and then get disgusted with it." It is said of Mill, and of the empiricist school generally, that they do not allow sufficient importance to mind in the inductive process. This is well expressed by De Morgan as follows:—"Modern discoveries have not been made by large collections of facts, with subsequent discussion, separation, and resulting deduction of a truth thus rendered perceptible. A few facts have suggested a *hypothesis*, which means a supposition proper to explain them. The necessary results of this supposition are worked out, and then, and not till then, other facts are examined to see if these ulterior results are found in nature. The trial of the hypothesis is the *special object;* prior to which hypothesis must have been started, not by rule, but by that sagacity of which no description can be given, precisely because the very owners of it do not act under laws perceptible to themselves.....What are large collections of facts for? To make theories *from*, says Bacon; to try ready-made theories *by*, says the history of discovery." It would seem, then, that colligation of facts, if not the whole of induction, is at least a necessary and a very important part thereof.

The essential steps in the inductive method from this latter standpoint are given as follows by Welton. The point to observe is the part played by hypothesis, and the diminished importance allowed to the mere enumeration of instances as opposed to the guiding and explaining that comes from the mind within by the conception of appropriate hypotheses.

1. Formation of a hypothesis suggested by a first observation of facts.
2. Deduction of the consequences of this hypothesis.
3. Testing these consequences by a careful analysis of phenomena.
4. Consequent exact definition of the hypothesis, which then, as expressing the true universal nature of reality, is verified and received as an established theory or law.

Book II., Chap. iii.—Nature is uniform, so that what is true in certain cases will be true in all other cases resembling these in certain assignable respects. The connection between induction and this principle of uniformity is very close, the principle being the major premise in the inductive syllogism: thus,—

Whatever is true of A, B, C, is true of all men.
A, B, C are mortal,
Therefore all men are mortal.

Or again,—

Under the same conditions the same event will always happen.
Under conditions x, y, z, E has been found to happen;
Therefore under conditions x, y, z, E will always happen.

Simple enumeration.—This is the process by which the truth of uniformity in nature has been arrived at. The argument is as follows:—Nature has always been found to be uniform; any instances to the contrary would surely have been noted and recorded; hence we assume, as above, that nature has always been uniform, from which we proceed to infer that nature will always be uniform. It is claimed that although simple enumeration is eminently unreliable in general, yet in this particular case we are so well informed as to the non-occurrence of instances to the contrary, that the principle can be accepted as rigidly true, it being "an empirical law co-extensive with all human experience, at which point the distinc-

tion between empirical laws and laws of nature vanishes." It is pointed out that this involves a *petitio principii*, for the statement is quite meaningless unless it is allowed that nature is uniform; otherwise, how can we be assured that cases of non-uniformity may not arise? It is not conceded that a knowledge of the uniformity comes to us from experience. On the contrary, it is affirmed—and Mill himself allows it—that nature presents not uniformity but multiformity. Hence, although it is admitted that the ground of all induction is the acknowledged uniformity in nature, it is not admitted that our notion of nature as uniform can come from the mere observation of facts and phenomena. "If we had needed merely to open our eyes in order to see uniformity in nature everywhere before us, belief in the thorough-going constancy of the way in which causes act would not have been so slow to arise, nor have been still only a scientific and not a popular belief; nor would the tendency to make capricious powers, demons, and gods responsible for what happens in the universe have been so deeply rooted" (Sigwart). The belief in uniformity in nature comes from within as a product of the mind's reflective activity, and not from without as the teaching of experience. Phenomena are interrogated in order to discover proofs of the existence of this uniformity, which is suggested to us by reason that "it is just this interrogation that has to be accounted for, for it is only on the supposition of uniformity that we make the interrogation. How can this be if the supposition is only derived from the observation of uniformity—an observation which presupposes the interrogation?" (Green). The student will therefore be wise to accept the doctrine of uniformity as put forward by Mill as the ground of induction, but she will be wise to weigh well both sides before accepting the explanation of this belief as put forward by Mill. On this subject Green writes as follows:—"The conception on our part of nature as a system of which every part or process is determined by relation to all the rest, is merely a development of the original determination of our feelings by relation to one thinking subject; and the reality of nature as a system consists in the relation of its multiplicity to one thinking subject, which distinguishes itself from it, but determines it, makes it what it is, by this distinction of itself from it."

Book III., Chap. v.—Note that the law of universal causation comprises two statements: (*a*) that every phenomenon that begins must have a cause; and (*b*) that the effect will invariably appear when the cause is present, unless some other effect of another cause counteracts it. For an effect to be produced, then, two conditions must be fulfilled—namely, that certain things must be present and certain things must be absent. Two definitions of cause may thus be given according as we take into account the negative conditions which must be absent if the effect is to appear or no. Thus a cause is the totality of phenomena, both positive and negative, which being present, some event (the effect) invariably and unconditionally follows; or, leaving out the negative conditions, we may say that a cause is an assemblage of phenomena, which being present, the effect follows, unless some negative conditions prevent. These counteracting causes must be well considered.

Cause, Condition, and Occasion.—Speaking strictly, a cause comprehends the totality of conditions necessary to the effect; but certain conspicuous portions of these antecedents are popularly singled out, and to them is given the name *cause*, the remainder of the phenomena antecedent to the event being described as the conditions. The **last** of the antecedent conditions is thus singled out, and has been given the special name **occasion.** Again, the most peculiar or special of the sum of conditions is frequently spoken of as the cause, whilst to the scientist the condition which is least likely to have been known is frequently referred to as the cause.

Causation and Sequence.—It is in this connection that Mill most deserves consideration, as he tends to regard causation as sequence, and nothing else, which is far from being the case. Douglas in his fourth chapter combats this view, and the student must carefully read what is said on this subject, so as to clearly understand what is meant by the statement that "such a view of induction implies that the conception of causality on which it rests is **not that of temporal sequence,** but that of **unconditional relation**" (p. 72). Welton's statement of the doctrine is very suggestive, and deserves quoting at length:—"In speaking of cause as the 'sum of conditions,' Mill really expressed, though somewhat awkwardly, the true doctrine. The expression 'totality of conditions' would have been better, for totality suggests that the conditions are integral and inter-related elements in a system, whilst 'sum' rather suggests a mere numerical addition of independent units. It is in totality of conditions that we must find cause, and this is not dependent on time sequence. For if we analyse any case of causation, we find that time sequence is not an essential aspect of it. The weight of the atmosphere is the cause of the height of the mercury in the barometer, but the two are co-existent. Contact with water wets, and contact with fire burns, but in each case the result is simultaneous with the contact. The fact to be accounted for is change; but change implies something which changes. We cannot find the explanation of change in preceding change, for that would simply land us in an infinite regress. Nor can the explanation of all the changes an object undergoes be found in the nature of the object itself; the changes of the same object are too multiform, and too evidently determined by changes external to the object, to permit that." It needs no argument to show that there is no real difference between agent and patient; the one has as much to do with the production of the effect as the other, and the distinction is merely one of convenience. Note what Mill says as to *permanent causes* or *primitive natural agents* such as the chemical elements, and periodical cycles of events such as the motions of the earth, and read what Douglas says concerning this (p. 67).

Book II., Chap. vi.—Here it is only necessary to call attention to the difference between *composition of causes* yielding a *compound effect*, and *combination of causes* from which results a *heteropathic effect*, and to observe that conjoined causes produce an effect which is always partly compounded and partly heteropathic, and never wholly heteropathic. That effects are proportional to their causes needs but to be stated to be accepted as true.

Book II., Chap. vii.—The difference between observation and experiment (or active observation) has already been insisted upon. We may, however, usefully enumerate the advantages of experiment over passive observation as set out by Mill:—

1. By it we may indefinitely *multiply instances.*
2. By it we may *isolate the phenomenon* under study.
3. By it we may *vary the circumstances.*
4. By it we may obtain the exact instances required.
5. It is generally the *only means of proving causation*, by taking the cause and seeing if it is capable of producing the effect in question. Hence, in those sciences where experiment is impossible, inductive inquiry is heavily handicapped, and we must rely mainly on deduction.

Book II., Chap. viii.—The four methods of induction must be especially well learned, as one or other of them is certain to crop up at the examination in some form or other. Jevons' chapter on the methods should now be carefully reperused. Note that by plurality of causes is meant the production of the same effect by totally different causes, and observe Mill's statement that this is the *characteristic imperfection of the method of agreement.* This does not apply to the negative method of agreement, which, however, is affected by the possibility of the absence of unknown antecedents, whereas the positive method is hindered by the possibility of their presence—that is, plurality of causes.

Book II., Chap. xxi.—In this chapter is discussed the question as to the ability of the process of simple enumeration to yield a valid induction—to wit, the law of causation. The student must remark well that simple enumeration is usually very fallacious—being, indeed, the source of many of the false opinions held by unreflecting and ignorant persons. Note also that the laws thus given are empirical laws, which, of course, are more and more reliable as experience of them becomes wider and wider—supposing always that instances to the contrary are not found, as Bacon claimed to be the case when a valid induction is obtained by this process. The opponents of Mill object to his statement that the law of causation is arrived at by simple enumeration. They claim that the knowledge of the existence of this law comes from within by intuition, and they object to Mill—firstly, that contrary instances are met with, so that his own conditions are not satisfied; and secondly, that the law being only an empirical one, even if "co-extensive with human experience," is unreliable, as such laws always are. These two points should be kept in view, and, in addition, the summary of proofs of the absolute truth of the law of causation should be well learned. They are:—1. It is known to be true of the majority of phenomena. 2. We do not know it to be untrue of any phenomena. 3. With respect to phenomena concerning which we do not know the law to be positively true, it may be observed (1) that they are continually passing into the category of phenomena known to be caused; (2) that the uncertainty is due to the rarity and obscurity of the occurrence of such phenomena; and (3) that these phenomena are known to obey some laws of nature, and hence it is more than likely that they obey the law of causation. With these few words, we leave the student to the careful revision of Mill by the light of the criticism that we have suggested, and that is suggested in the first four chapters of Douglas, and more especially the fourth.

Ryland's "Psychology," pp. 27-151.

Chap. ii.—What **consciousness** is will be more easily understood than expressed. Perhaps the best paraphrase of the term is, "awareness of mental phenomena." The law of relativity—namely, that change is necessary to consciousness—needs only to be stated to be understood and accepted. We only know "up" in relation to "down," etc. This brings us to consciousness of difference, to which must be added consciousness of likeness, both of which imply retentiveness; hence **differentiation, assimilation,** and **retentiveness** are the three conditions necessary to consciousness. Note the degrees of consciousness implied in (1) focus, (2) field, and (3) subconscious region. The last is only known by reference to the two former, and as an inference, as it is a contradiction in terms to speak of consciousness of the subconscious. To the L.L.A. student, from whom are required only the barest outlines of psychology, this point is of little importance. Attention, or concentrated consciousness, is of much greater importance, and should be studied with care as to (1) kinds—namely, automatic and voluntary; and (2) conditions—namely, those belonging to presentations, or the external factor, and those belonging to the individual, or the internal factor. Then comes the difference between sensation and perception, it being understood that pure sensation is utterly unknown, since the mind only knows a sensation by contrasting it with other sensations, which is an act of perception, for the mind is active in contributing remembered impressions which coalesce with the impressions received by way of the sense organs. Having grasped the fact that perception involves inference, and that in inference lurks fallacy, special attention may be given to section 5 (p. 127), as bearing upon Berkeley's theory. Note the opinion of Spencer—namely, that we have an intuitive knowledge of the existence of external objects, but that we are only justified in asserting objective existence apart from subjective existence; but as to the real nature of the external world, we have such knowledge only as is conveyed to us by way of our sense organs, whereas they may be something quite different from what our sensations and perceptions would have us believe. Read carefully, however, the last seven lines on p. 131, which set out a most important section of thought on this subject.

Space Perception.—In this section the student must attend carefully to the question as to the part played by touch and sight in the perception of space in two and in three dimensions. In particular must be studied the pros and cons involved in the question as to **whether distance is seen or inferred.** Of course, the section on Berkeley's theory of vision (p. 145) must be read again and again until thoroughly understood; but, at the same time, it must be remembered that "recent writers hold that the eye suffices to give us knowledge of two-dimensional space—that is, of a plane at right angles to the axis of sight"—and also that the eye gives sufficient data for the inference of distance, which is tantamount to the admission that distance *can* be seen. In particular, the statement of Professor James should be pondered over:—"The measurement of distance is, as Berkeley truly said, a result of suggestion and experience. But visual (retinal) experience alone is adequate to produce it, and this he erroneously denied" (p. 147).

Fraser's "Berkeley," chap. i.

The portions of Fraser set for study are pp. i-liii, and pp. 1-156. Professor Fraser's lucid introduction will first of all be studied; and at the outset it may be remarked that it is deserving of very attentive reading, not only as a guide to Berkeley, but also as a contribution to philosophy. The biographical notes may be left to the student. As to **Descartes,** it is to be understood (1) that he could not disbelieve his own existence, because of his ability to think—this is the meaning of the famous *cogito, ergo sum*, "I am conscious, and must therefore exist;" and (2) that objects have no existence for us except as bundles of sensations. This led up to the antithesis between conscious thought and dead matter. Locke also claimed that "consciousness shows that we have an intuitive knowledge of our own existence." He also claimed that God, or Eternal Mind, is believed as existing, because of "the demand of reason for an eternal cause of his own self-conscious existence," and that our knowledge of matter is obtained "only by sensation;" but these sensations (or, better still, perceptions) force upon us the conviction of the existence of matter. Note well what is said here as to primary and secondary qualities of objects (p. xx), and compare this with what was said by Ryland. Berkeley's **new question** was, "What is the meaning of existence of matter, and what do we mean by external cause?" Prior to this it had been presumed that matter was an *unconscious substance endowed by us with unknown powers*, and it was this belief that Berkeley attacked. He found that "what we call external things must be composed of the phenomena presented to us by our senses," not because of the existence of external objects possessing properties, but because "God, as supreme Reason and Will, is accustomed to maintain sensible things and their natural laws as we find them. This will be further explained as the subject is developed; but it must not be thought that the doctrine is silly, although it is believed to be erroneous. If the ever-active Reason of God provides stimuli which invariably give us all sensations from which we infer the existence of external objects, it would be just the same as though we got these same sensations from objects themselves; so that to Berkeley a theory was as real as to a materialist, albeit for quite a different reason. The student may now be left to read the first xxxi pp. for herself, bearing well in mind the suggestions outlined above.

Questions.

MILL.

1. Explain the double method of agreement. How does it differ from the method of difference? (1888, 1893.)
2. Explain the method of residues, its relation to the other inductive methods, and its dependence on the law of universal causation. (1890.)
3. Explain the method of concomitant variations, and give examples of its application. What is its relation to the other inductive methods? (1891.)
4. What is meant by (1) natural law, (2) cause, (3) the ground of induction? (1891, 1893.)
5. What advantage has the method of difference over the method of agreement? Discuss their validity. (1894.)
6. "When Mill suggests in one sentence that the uniformity of nature is a result arrived at by complex and developed induction, and in the next that every induction really assumes this principle, he takes the principle in different senses." Discuss this criticism. (1898.)
7. Explain and illustrate Mill's method of difference. How are the other methods related to it? (1898.)
8. Explain and exemplify Mill's "joint method of agreement." How is it related to the method of difference? (1897.)
9. State clearly Locke's account of primary and secondary qualities. (1888, 1895, 1898.)
10. What account does Locke give of the idea of substance and of cause? Does his explanation seem to you satisfactory? (1888.)
11. State Locke's views as to the extent of human knowledge. (1888.)

Answer to Query.—It would be impossible for you to go through the whole course in the short time—about three months—between now and the examination. It is, moreover, only intended that the answers of those students who follow the course from the commencement should be corrected for the nominal fee charged.

Answers to the questions set are corrected by the author of this course at a charge of 10s. for the whole series of questions.

All communications should be addressed "L.L.A. COURSE," c/o Editor *P. T.*

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LONDON MATRICULATION.

June 1899.

BY R. C. B. KERIN, B.A. (LOND.),
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AND

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Late Scholar of St. Catharine's College, Cambridge.

LATIN.

Course for April.

1. Cicero, *Pro Marcello.* Revise the first half.

2. Grammar.—Learn the verbs of the fourth conjugation that are irregular in the perfect and supine. In the Syntax, learn the rules for (*a*) conditional or hypothetical clauses, (*b*) relative clauses, (*c*) casual clauses. Learn the various methods of expressing purpose and result. The construction used after verbs of fearing should be thoroughly known.

3. *Anglice Reddenda*, 76–84.

4. Sentences from Bradley's Arnold or Bayfield's or Allen's *Exercise Book.*

Latin Grammar Notes.

The normal rules for conditional statements are as follows:—

1. If the indicative or the imperative is found in the apodosis (principal clause), the indicative is used in the protasis ("if" clause).

2. If the subjunctive is in the apodosis, the subjunctive is also used in the protasis. The subjunctive is used in the apodosis if there is a "would" or "would have" in English, or the equivalent of "would" or "would have:" for example, "could have" is generally = "would have been able." The best practical rule for the student to go by is this: let him look to the apodosis and see whether the subjunctive will be required as above; if not, let him use the indicative in both the protasis and apodosis.

Now, the next question is that of the tense to be used. If the subjunctive is required, use the present subjunctive to denote future time, the imperfect subjunctive to denote present time, and the imperfect or pluperfect subjunctive to denote past time. (The imperfect will denote a continuous action, while the pluperfect will denote a momentary or antecedent action. Occasionally we find the imperfect used for pluperfect—as, *vellem*, "I should have wished.") If the indicative is used, the tenses will be the same as in English, except in regard to future time, where in English, in the protasis, the present is often used to denote future time. In that case the simple future must be used in Latin in both clauses if both actions go on together in the future; but if one is over before the other begins, the future perfect and future are to be used—for example, *Veniet si poterit*, "He will come if he can;" *Si hoc feceris, te poenitebit*, 'If you do this, you will repent." In the first case, the actions denoted by *veniet* and *poterit* go on together; in the second case, the "doing" is over before the "repentance" begins. The literal translations are—"He will come if he will be able;" "If you shall have done this, you will repent."

Purpose (or *final*) clauses are expressed in Latin by (*a*) *ut* and subjunctive, (*b*) *qui* and subjunctive, (*c*) *ad* with gerund or gerundive, (*d*) genitive of gerund or gerundive with *causa*, (*e*) supine in *-um* after verbs of motions. *Result* (or *consecutive*) clauses are expressed by *ut* and the subjunctive. The relative with the subjunctive often indicates a result. Avoid using the infinitive to express a purpose; there is no mistake which is so often made. Remember that "that not" is translated by *ut non* in a negative result, by *ne* in a negative purpose. In the same way, *ut nemo* is, "so that no one;" *ne quis*, "in order that no one;" *ut nunquam*, "so that never;" *ne unquam*, "in order that never" or "lest ever;" *ut nusquam*, "so that nowhere;" *ne usquam*, "lest anywhere."

Verbs of fearing are followed by (*a*) *ne* and subjunctive to represent a "that" clause in English; (*b*) *ut*, or *ne non*, to represent a "that not" clause in English; (*c*) infinitive when there is an infinitive in English—for example, *Timeo ne hoc faciat; timeo ut (ne non) hoc faciat; timeo hoc facere.*

The subjunctive is used in relative clauses when the relative denotes (*a*) Purpose, (*b*) Result, (*c*) Concession, (*d*) Cause. Under heading (*b*) comes the case when the antecedent of the relative is an indefinite word, as when the relative refers to a class and not to definite persons or things. This subjunctive is sometimes known as the descriptive or generic subjunctive. It is very common in Latin. Distinguish *is est qui hoc facit*, "he is the very man who does this," from *is est qui hoc faciat*, "he is just the man to do this."

Quod, meaning "because," takes the subjunctive when the reason alleged is not the reason of the speaker or writer, but that of some one else—for example, *laudat eum quod hoc faciat*, "he praises him for doing this" (as he says); *eum quod patrem interfecisset accusavit*, "he accused him of slaying his father" (because, as he said, he killed his father). *Non quo*, "not because," nearly always requires the subjunctive; because if you deny a reason, you deny it because some one has brought or is likely to bring it forward. These subjunctives are due really to *oratio obliqua*, and are called subjunctives of *sub-oblique oration.*

The following summary, taken from Postgate, will be useful:—

Translation of "that." The English "that" must be differently translated into Latin according to its sense:—1. After words of *saying* and *thinking*, by infinitive and accusative. 2. If it means "the fact that," by *quod*. 3. If it denotes "consequence," by *ut*, etc. 4. If it denotes "purpose," by *ut*. 5. If it denotes "the object of fear," by *ne*. 6. After negatives, often by *quin*. 7. "Oh that" is expressed by *utinam*.

Translation of "to." The English "to" with verbs is translated:—1. By the simple infinitive. 2. After verbs of hoping, threatening, and promising, by the future infinitive and accusative. 3. "To" of purpose is variously expressed in Latin. For "He sent soldiers to burn the town" we may have:—

Misit milites
(1) ut urbem cremarent.
(2) qui urbem cremarent.
(3) ad urbem cremandam.
(4) urbis cremandae causa.
(5) urbem crematum.

Typical Sentences.

27. "It is of no great importance to you and your friend whether we fire on the enemy or retreat into the woods."

Utrum in hostes tela coniiciamus an nos in silvas recipiamus tua et amici tui non magni interest.

Notes.—1. "It is of importance to" is expressed by *interest*. Now the dative must not be used after *interest*. The person to whom a thing is of interest is expressed by the *genitive*, except when the person is represented by a personal pronoun of the first or second person, or by the third reflexive. In the latter case, the ablative feminine singular of the corresponding possessive adjective is used. Hence above we write *tua* and *amici*.

2. The subjunctives *coniiciamus* and *recipiamus* are due to the fact that they are the verbs in a dependent interrogative sentence; *nos* is the objective of *recipiamus*. Note the tenses of the subjunctive, and see the rules for the sequence of tenses.

3. *Utrum.....an* = "whether.....or" in interrogative sentences. Be careful not to use *sive.....sive* (found in adverbial sentences), or *aut.....aut*, "either, or."

28. "All of them were afraid that the king would commit suicide before the consul would arrive at the city of Athens."

Ne rex mortem sibi consciscceret antequam consul ad urbem Athenas perveniret omnes timebant.

Notes.—1. After verbs of fearing (*a*) a "that" clause is expressed by *ne* and the subjunctive; (*b*) a "that not" clause by *ne non* or *ut* and the subjunctive; (*c*) an infinitive by an infinitive—for example, *Timeo ne non hoc faciat*, "I fear that he will not do this;" *Mori timeo*, "I fear to die."

2. Note the phrase for "to commit suicide."

3. *Antequam* is here followed by the subjunctive, because the sentence is a dependent sentence in *oratio obliqua*. It forms part of what they thought when they feared. In Latin, whenever a sentence expresses not the idea or thought of the speaker or writer but that of some one else, the subjunctive is used in that sentence.

4. "All of them" = "they all" = *omnes*. *Omnes eorum* would be bad Latin. The partitive genitive would be absolutely wrong.

29. "We said that it was not every one who knew what measures to adopt at such a crisis as this."

Quae consilia in hoc tali discrimine capi deberent scire cuiusvis esse negavimus.

Notes.—1. "It is not every one" = "it is not the characteristic of any one you please." The predicative genitive of *quivis* is used. "Any one," when it means "any one you please," is translated by *quivis*. *Quisquam* in a negative sentence means, "no one at all."

2. Be careful not to use the infinitive in Latin in cases similar to the above. The deliberative subjunctive, or *debeo* with infinitive, must be used. "What measures to adopt" is equivalent to "what measures are to be" or "ought to be adopted."

3. The subjunctive is due to the dependent question.

4. The Latins could not say, *in tali discrimine quam hoc*, when two things are not compared, but said, "this such a crisis."

30. "The famous Balbus threatened to put in chains all the best men if the soldiers did not leave the city of Capua before the arrival of the general."

Balbus vir praeclarus se optimum quemque in vincula coniecturum est minatus nisi milites ante ducis adventum ex urbe Capua excessissent.

Notes.—1. An adjective is not attached to a proper name, unless a word like *vir, homo, femina* is used. *Praeclarus Balbus* would not be good Latin. The Romans said, *Pompeius Magnus*, but *magnus* in this instance was used as a kind of title.

2. Note the future infinitive after *minor*. It is not necessary to express *esse*.

3. *Excessissent* is in the subjunctive because it is in *oblique oration*. It is part of what Balbus said when threatening. Reported speech in Latin, when the exact words uttered are not reported, requires the subjunctive in the dependent clauses (*sub-oblique oration*).

4. Note how to express "all the" and a superlative. In Latin the superlative adjective and *quisque* are used; *quisque* is placed after the superlative.

5. For *ab urbe Capua* see previous sentences. Avoid writing *ab urbe Capuae*.

31. "It is your interest to do this as soon as possible."

Hoc facere quam primum tua interest.

Notes.—The infinitive can be used in Latin as the subject of an *impersonal* verb. *Ut* and the subjunctive might have been used above, though in the case of most impersonal verbs you have not a choice. Some verbs require *ut* and the subjunctive—for example, *accidit;* others the infinitive—for example, *poenitet:* with *poenitet, ut* would not be permissible.

32. "He does not know whether he will go to Syracuse or not."

Utrum Syracusas necne iturus sit nescit.

Notes.—1. "Or not," in the second part of a disjunctive question, is expressed by *annon* if the disjunctive question is a direct one; by *necne* (usually) if the disjunctive question is an indirect one. Hence in the sentence above *necne* is normal.

2. The future subjunctive, if it is necessary to express it, is formed by the future participle with the subjunctive of *sum*.

3. The subjunctive is due, of course, to the dependent question.

33. "What was he to say? If he admitted that you were so foolish as to spare this man, every one would have blamed him."

Quid diceret? Nam si te tam stultum fuisse ut huic parceres esset confessus, omnes eum culparissent.

Notes.—1. *Diceret* is deliberative subjunctive.

2. *Quid* must be used, not *quod*. The former is the interrogative pronoun, the latter the interrogative adjective or relative pronoun.

3. The subjunctive is used after *si* because the subjunctive is used in the principal clause. The subjunctive is used in the principal clause because there is a "would have" in English.

4. "So foolish as to" must not be translated by *tam stultus quam*, etc. "So foolish as....." when a comparison is drawn between two persons, is translated by *tam stultus quam*.

5. Note the subjunctive after *ut* consecutive.

6. *Parco* governs the dative.

Sentences for Practice.

(Solutions will be corrected on enclosing seven stamps.)

1. We know that it is not to your interest to find out (*comperio*) who did this.

2. I am inclined to think (*haud scio an*) that he is afraid the enemy may seek cover (*tela vitare*).

3. What were the soldiers to do? If they wheeled round (*convertere signa*), the enemy would attack them at once.

4. No one ought to inform him of this matter.

5. Each of us promised him to send supplies (*commeatus*) if he enrolled (*conscribo*) troops at once.

6. They cannot threaten to put him to death if he disobeys the commands of the senate.

7. I know that it is not every one who can encourage (*exhortor*) the soldiers to attempt so desperate a task (*negotium*) as this.

8. The brave Balbus charged the enemy without waiting for (*exspecto*) the orders of the commander.

9. He was so annoyed with the soldiers that he left the city of Syracuse without delay.

10. So far is he from reading the *Pro Marcello* of Cicero that he will not read any Latin book.

Latin Test Paper.

(Solutions will be corrected on enclosing seven stamps.)

1. Give the pluperfect subjunctive, active and passive, third singular; the future participle, active, genitive, feminine, singular; and the present participle, dative, plural, of verbs compounded of—*ad* and *cumbo, ab* and *do, re* and *fallo, re* and *farcio, cum* and *fateor, ab* and *fero, cum* and *frango, ad* and *gradior, prae* and *habeo, cum* and *laedo;* and also of *porricio, allicio; maneo, misceo, facesso, affligo*.

2. How are questions asked in Latin—(*a*) direct, (*b*) indirect, (*c*) disjunctive? Give examples.

3. State the rule for the sequence of tenses.

4. Distinguish between *haud, non*, and *ne*. Give examples.

5. Write out sentences illustrating the difference between *sive.....sive* and *utrum.....an*.

6. What construction is required by *postquam, cum, qui, quamvis, utor, peto, fruor, dignus, invideo, consulo, spero, parco, moneo, persuadeo, impero, haud scio an?* Write out short sentences introducing these words.

7. Give the Latin for—28 times 5; 2,332 men; 2,000 women; 24 times; the year 1654.

8. Correct or justify—

(*a*) Cives Romae ab illis Athenarum parcebantur.

(*b*) Hoc facere debuit ut abeas ad domum (He ought to have done this in order that you might go away to your home).

(*c*) Quisque militum te hoc facere imperaverunt.

(*d*) Nomen Balbi et id fratris veremur (B.'s name and that of his brother).

9. Comment on peculiarities in the declension of—*vulgus, nemo, iusiurandum, iussu, vis, iuvenis, tussis, locus*.

ENGLISH.

Course for April.

1. History.—James the First and Charles the First.

2. Grammar.—Nesfield, pages 266–301. Revise nouns, adjectives, and pronouns.

3. Literature.—Stopford Brooke's *Primer of English Literature*, chaps. v. and vi.

Notes.

Grammar.—Note the origin of our alphabet. Note how our alphabet differs from the Anglo-Saxon alphabet. Note how our alphabet was affected by French influence. The classification of the alphabet in different ways should be known. Note especially the definition of *mutes, continuants* or *spirants, liquids, voiced consonants, voiceless consonants*. Note in § 434 instances of *substitution*. § 435. Instances of assimilation. Show the influence of this on inflections. § 436. Metathesis. § 437. Explanation of the "uncertainty" of the initial *h*. § 438. Palatalisation. Note vowel mutation and vowel gradation. Chap. xxiv. is extremely important. The history of English spelling should be known thoroughly. Note the causes which led to the decay of the phonetic system. Be able to explain the anomalies in modern English spelling. Note what is essential for a perfect alphabet.

MATHEMATICS.

GEOMETRY COURSE.

Revise Book I. and read Book IV.

Of the problems and theorems at the end of Book III. (Hall and Stevens) the following should be read:—17, page 218; 36, page 221; 19, page 224; 74, page 232; 21, page 235; 23, page 236; 1, page 240; 2, page 242; and 3, page 243.

Solutions to last month's riders:—

1. Let PQ be the given straight line. On it describe a segment, PBQ, of a circle capable of containing the given vertical angle; at P draw PA perpendicular to PQ, and make PA equal to the given altitude; through A draw ABC parallel to PQ, cutting the circle in B and C. Then PBQ or PCQ will be triangles satisfying the given conditions.

2. Is proved in Hall and Stevens, and is included in the list given above.

3. Let ABCD be a parallelogram described about a circle PQRS, and let P, A, R, and S be the points of contact of the sides AB, BC, CD, and DA respectively.

Then, since tangents from an external point to a circle are equal,

$$\therefore BP = BQ,$$
$$AP = AS,$$
$$DR = DS,$$
$$CR = CQ.$$

Adding these equals, we get

AB and CD = CB and AD,

or, 2AB = 2CB by I. 34,

$\therefore$ AB = CB.

4. Using the figure of II. 5, as given in Hall and Stevens, let AP and PQ be sides of the given squares. Produce PQ to B so that PB = PA.

Then by II. 5, rect. AQ, QB = $AP^2 - PQ^2$

= difference of given squares.

Riders for April :—

1. Prove II. 13 by the figure of I. 47, using only the First Book.
2. What is the magnitude of the vertical angle of the isosceles triangle described in IV. 10?
3. Inscribe a regular hexagon in a circle by a construction differing from Euclid's.

ARITHMETIC COURSE.

Chap. xl. with the exception of cube root, and plenty of the examples.

Answers to last month's sums :—

1. £400.
2. $15\frac{5}{11}$ shillings.
3. The big hand of a clock goes through the 60 minute-spaces whilst the little hand goes through 5 minute-spaces.

   $\therefore$ in 60 min. time the B.H. gains 55 min.-spaces on the L.H.

   $\therefore$ the B.H. gains 1 min.-space on the L.H. in $\frac{12}{11}$ min. time.

   At 7 o'clock the L.H. is 35 min.-spaces ahead of the B.H., so that, for the hands to be opposite, the B.H. must gain 5 on the L.H. This it will do in $\frac{5 \times 12}{11}$ min. time, so that the time will thus be $\frac{60}{11}$, or $5\frac{5}{11}$ min. past 7.
4. 13 will divide 145 and 1367, both with remainder 2, as it is the H.C.F. of 143 and 1365, these two latter numbers being each 2 less than the original ones.

Questions for April :—

1. Find to 6 significant figures the square root of 2.
2. Find to 3 decimal places the values of $\frac{1}{\sqrt{2}}$, $\frac{1}{\sqrt{3} - \sqrt{2}}$, and $\sqrt[4]{2}$.
3. What price should be paid for a 5 per cent. stock by a person satisfied with $4\frac{1}{2}$ per cent.?
4. Of two clocks one gains 5 minutes and the other loses 10 in an hour. How often will they show the same time?

ALGEBRA COURSE.

Chap. xxix. and, say, every alternate example.

Chaps. xxvii., xxviii., and xxix. are all important.

Solutions to last month's examples :—

1. By formula $a^3 + b^3 + c^3 - 3abc$

$= (a+b+c)(a^2+b^2+c^2-ab-ac-bc)(x-3y)^3+(2x-y)^3 + (4y-3x)^3 - 3(x-3y)(2x-y)(4y-3x)$

$= (x - 3y + 2x - y + 4y - 3x)[(x-3y)^2 + (2x-y)^2 + \ldots]$

$= 0 \times$ some other factor

$= 0.$

From this, by taking over the term $3(x-3y)(2x-y)(4y-3x)$, the required result follows.

2. $(x^2 + y^2 + z^2 - xy - xz - yz)^2 - (x-y)^2(y-z)^2$

$= (x^2 + y^2 + z^2 - xy - xz - yz)^2 - (xy - xz - y^2 + yz)^2$

$= (x^2 + z^2 - 2xz)(x^2 + z^2 + 2y^2 - 2xy - 2yz)$ by formula $a^2 - b^2 = (a+b)(a-b)$

$= (z-x)^2[(x-y)^2 + (y-z)^2]$

$= (z-x)^2(x-y)^2 + (z-x)^2(y-z)^2.$

3. $3x^2 - 2y^2 + 5xy + 2x - 3y - 1$

$= 3x^2 + x(2+5y) - (2y^2 + 3y + 1)$

$= 3x^2 + (2+5y)x - (2y+1)(y+1)$

$= [3x - (y+1)][x + (2y+1)].$

4. Putting $x^2 - 3x = y$,

we get $y + \frac{1}{y} = 10\frac{1}{10}$, which when solved gives

$y = 10$ or $\frac{1}{10}$.

Taking $x^2 - 3x = 10$, we get $x = 5$ or -2.

Taking $x^2 - 3x = \frac{1}{10}$, we get $10x^2 - 30x - 1 = 0$,

or, $x = \frac{30 \pm \sqrt{940}}{20} = \frac{15 \pm \sqrt{235}}{10}$.

5. $x^3 + 1 = 0.$

$\therefore (x+1)(x^2 - x + 1) = 0.$

$\therefore$ either $x + 1 = 0$, that is, $x = -1$,

or, $x^2 - x + 1 = 0$; that is, $x = \frac{1 \pm \sqrt{-3}}{2}$.

Examples :—

1. Factorise $a^2(b-c) + b^2(c-a) + c^2(a-b)$.
2. Divide $1 + a^3 + 8b^3 - 6ab$ by $1 + a + 2b$.
3. Factorise $2x^2 + 5xy + 2y^2 + x - y - 1$.

GENERAL ELEMENTARY SCIENCE.

Chaps. xii., xvii., xviii., together with a revision of the first four chapters.

Test paper :—

1. Find the lowest number which, when divided by 2, 3, 4, 5, 6, 7, 8, and 9, gives remainders 1, 2, 3, 4, 5, 6, 7, 8 respectively.
2. Describe a circle touching a given circle and a given straight line.
3. A mass of 10 lbs. is suspended by a string which is drawn aside at 60° from the vertical by means of a horizontal force acting on the mass. Draw a diagram showing the forces acting, and find the tension of the string.
4. Factorise $1 + y(1+x)^2(1+xy)$.
5. Having given $x + \frac{1}{x} = 11$, find $x - \frac{1}{x}$, and hence x.
6. Explain clearly how a stick partially immersed in water appears bent.
7. A balloon at a height of 2,000 feet is rising at a speed of three miles an hour; how long will a stone let fall from it take to reach the ground?

The Royal Botanic Gardens Club.—The Royal Botanic Society has now erected club buildings in its gardens, which have been leased to a club limited to fellows of the society. Three hundred fellows, including a large proportion of ladies, have been elected to the club.

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Technical Science in Germany.—During the last fifteen years there has been a steady increase in the number of students who have taken up advanced courses of technical science in Germany. There are in the empire nine polytechnics, the one having the smallest number of students being Brunswick with 363 students; while Berlin, with 2,906 students, is the most frequented. The total number of polytechnic students is 10,000. About 3,000 trained technical students thus become available every year.

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A New Botanic Garden.—A British Botanic Garden is to be established at Perry Hill. Mr. P. Cochrane, who was for some time at the Royal Gardens, Kew, under Sir J. D. Hooker, is about to form there a complete collection of British plants. The garden will be tastefully laid out, and will include fresh-water and marine plants. All specimens are to be labelled with their common and botanical names, and the names of the natural orders to which they belong. Mr. Cochrane, and some other botanists and horticulturists, will give information to visitors concerning plants and methods of cultivation. Subscribers are invited to assist in defraying the expenses of forming and maintaining the garden. The support of a limited number of subscribers is invited. Subscribers of five shillings per annum will be entitled to visit the garden at all seasons between the hours of two and nine p.m. The garden will be sufficiently advanced for inspection by the first of May 1899, and subscribers' admission cards will be available for one year from that date.

Our "FRENCH AND GERMAN PRIZE COMPETITION" is unavoidably held over, and will appear next month as usual.

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Head-Master of the Belvedere Pupil Teachers' Centre, First on Scholarship List, Author of "Scholarship School Management."

SPRING EXAMINATION, 1900.

First Month—April.

WORK TO BE PREPARED.

WITH this month we commence a new Course for pupil teachers, and as at the time of writing the new Code has not been issued, the present instalment of work is based on the work as prescribed in last year's Code. Any alterations which may appear will be noticed in our next issue. The paraphrase, parsing, and analysis of the special books set cannot, of course, be yet proceeded with.

It may be useful to explain to those of our readers who intend to utilise these Courses what the object of them is, and how they may be used with greatest advantage. There are many pupil teachers who have not the opportunity of attending central classes—teachers who have to work by themselves, and are perhaps unable to obtain efficient instruction. It is for these primarily that the Courses are designed. The work is arranged in monthly portions, to ensure a regular system of work, notes and explanations of difficulties are added as far as space will allow, and periodical test examinations are given exactly on the same lines as the Government examinations. But as it necessarily arises that many points are not dealt with which may puzzle the individual student, all our readers are cordially invited to write for assistance in the solution of difficulties in the work, or for general advice on selection of books, modes of study, or any other topic connected with their work. Specimens of work are marked gratis, and, if desired, arrangements can be made for marking the monthly set of test questions. Any pupil teacher steadily working by this Course, and availing himself of the opportunities it offers, cannot fail to make satisfactory progress, and can rely on passing his examinations with credit. With these few words of explanation, we pass to the consideration of the subjects of Schedule V. in detail.

A.—*English.*

First Year.—This month may be utilised in preparing "the ordinary termination of English words"—that is, the suffixes, a list of which will be found in any good text-book. It is not sufficient to learn the meaning of the suffix, but also its function must be noticed. A table should be made to show both of these. For example:—

Suffix.	Example.	Meaning.	Origin.	Function.
en	Oxen	Inflection for plural	Anglo-Saxon	To form plurals.
en	Kitten	Diminutive	"	Forms one noun from another.
en	Golden	Made of	"	Forms adjective from noun.
en	Brighten	To make	"	Forms verb from adjective.
en	Written	——	"	Participial ending.

Second Year.—Chief Latin prefixes and terminations. Arrange as pointed out in First Year.

Third Year.—Prefixes and affixes generally. Knowledge of the simple tests by which English words may be distinguished from those of foreign origin.

B.—*Reading and Repetition.*

Special books not yet published, but practice in oral reading should be taken—five or ten minutes each day being sufficient, especially if taken before a competent critic.

C.—*Penmanship.*

Ten minutes' practice per diem from a good model. All pupil teachers should use the copy book specially prepared for them, and issued from the Office of this Journal, price 1s. Enough material will be found for a year's practice. Good writing is of great advantage in every written examination, and hence much care should be taken to acquire a good style. Good paper, good ink, and a good pen are essentials.

D.—*Arithmetic.*

First Year.

Boys.—Vulgar Fractions: Addition and Subtraction. Learn exact definitions of the various kinds of fractions, and be prepared to prove addition and subtraction by diagrams, for which see text-book or *Scholarship School Management*.

Girls.—Simple Practice. Learn definition of practice; aliquot parts. Arrange the sums to show the value of each line. Note what is to be done when there is a fraction—as, $763\frac{4}{5}$ at £2, 13s. 4½d. Work as for 763, and then add $\frac{4}{5}$ of price of one, unless the fraction can readily be expressed as an exact part of £1.

Second Year.

Boys.—Ratio and Simple Proportion. The theory of ratio must be studied, and the definitions of such terms as Antecedent, Consequent, Direct and Inverse Ratios, Duplicate, Triplicate, and Sub-duplicate Ratios. Proportion is the equality of two ratios. As $a : b :: c : d$ means—whatever relation a bears to b, c bears the same to d. Learn the truths which may be deduced from this— $\frac{a}{b} = \frac{c}{d}$, $\frac{a}{c} = \frac{b}{d}$, $ad = bc$, etc.—and be prepared to prove each. Work sums both by proportion and method of unity. An excellent collection is to be found in Christian and Collar's *New Arithmetic*.

Girls.—Vulgar Fractions: Multiplication and Division. The proof of the rule of these operations must be prepared, with diagrams to illustrate. Note that in cases like $\frac{2}{3} + \frac{3}{4} \times \frac{4}{5} + \frac{3}{7}$, the × sign acts like a bracket, and $\frac{3}{4} \times \frac{4}{5}$ must be reduced to one fraction before any addition or subtraction takes place. Similarly with division.

Third Year.

Boys.—Square Root and its application. The rule for finding the square root in arithmetic is deduced from the rule in algebra. The square of $a + b = a^2 + 2ab + b^2$, and hence the square root of $a^2 + 2ab + b^2 = a + b$. How is this obtained? 1. By taking the square root of the first quantity. $= a$. 2. Square this and subtract, and bring down the next two quantities. 3. To find a trial divisor, double the quotient $= 2a$, divide $2ab$, result $= b$, add this to quotient and to divisor. 4. Multiply and subtract. This is exactly the rule in arithmetic. Note why numbers are marked off in sets of *two* figures—the square of any number of one digit has less than three figures. The application is largely used in solving problems based on Euclid I. 47. In a right-angled triangle the square on the hypotenuse = the sum of the squares on the sides. Hence, any two sides being given, it is possible to find the third side.

Girls.—Decimals. Read up the theory carefully, and be prepared to prove the correctness of any operation by vulgar fractions. For this month Addition, Subtraction, and Multiplication. Why is it wrong to read ·375 as "decimal three hundred and seventy-five"? Work as many examples as necessary to secure thorough knowledge.

E.—*Geography.*

Work for the year—Africa, America, Australasia, and Polynesia. This is a large quantity to prepare adequately, and will demand, on the part of girls especially, unremitting care and study. Use must everywhere be made of sketch maps; reliance on "looking at" an atlas is insufficient. *Always* construct an outline, and fill in those details only which are to be remembered, and then go over them continually till known. Read also any books of travels, handbooks issued by shipping firms, school geographical readers, etc., but *not* until you have obtained a clear idea of the position, shape, and leading characteristics.

For this month—*Africa: Physical Features, Climate, Productions, and People.* Any good text-book will supply these, but there are one or two points which need careful consideration.

1. Why is Africa called the "Dark Continent"?
   - (*a*) On account of being inhabited by the black negro race.
   - (*b*) On account of the lack of civilisation, and the little known about it till quite recent times.

   Difficulties in way of explorers:—Compact land mass not broken up by inland seas. River communication difficult owing to sandbanks at mouth and cataracts in course. Intense heat and low malarial belt round coast. Impossibility of using animals for transport, owing to the climate and tsetse fly; hence all goods, etc., must be borne by carriers. Continual intertribal warfare. Mohammedan fanaticism, and general character of country.

2. The partition of Africa amongst the European Powers. Meanings of Hinterland and Spheres of Influence.

3. The exploration of Africa during the present century. Really a series of river problems—Bruce, Burton, Speke, and Grant on the Nile, Mungo Park on the Niger, David Livingstone on the Zambesi, Stanley on the Congo.

4. Compare and contrast the Sahara and the Soudan.

Productions.—Tabulate and learn. Note ostrich farming in the south, and the ivory trade intimately connected with and carried on by means of the horrible slave trade in the Soudan and centre. Diamonds from Kimberley, gold from the rich reefs in Transvaal and Mashonaland, and from alluvial deposits on the Gold Coast.

Races.—(1.) Hottentots and Bushmen in the south and south-west.
(2.) Kafirs and Bechuanas in south central parts.
(3.) Negroes in the Soudan.
(4.) Kopts in Egypt (representatives of the old Egyptians).
(5.) Arabs in the Sahara and Soudan, of which the Zulus are a branch.

Religion.—Mohammedan in the Arab nations; idolaters and nature worshippers in the Negro and Bantu families.

F.—*History.*

Work for the year—From the accession of William and Mary to the present time.

For this month—*William and Mary.*

Chief Points:—

1. *Completion of the Revolution.*—"The glorious Revolution," because it settled all the points which had been in dispute between the king and parliament for centuries, initiated government by the Commons, and indirectly government by party. Learn carefully the terms of the Bill of Rights.

2. *Reduction of Scotland.*—Battle of Killiecrankie; building of Fort-William; complete submission of Highland clans (1691); massacre of the Macdonalds of Glencoe for delay in tendering submission.

3. *Reduction of Ireland.*

1689. Landing of James; siege of Londonderry; meeting of Jacobite Parliament; raising of siege of Londonderry; defeat of James's army at Newtown Butler.
1690. William lands; battle of Boyne; capture of Waterford; siege of Limerick; capture of Cork and Kinsale.
1691. Defeat of Irish at Aughrim by Ginkel; capture of Limerick; Peace of Limerick—
(α) 12,000 Irish soldiers allowed to go to France, where they formed the famous Irish Brigade.
(β) Romanists to enjoy all privileges compatible with law.
(γ) Amnesty to all taking oath of allegiance.

4. *Foreign Affairs.*—William's policy to curb the power of Louis the Fourteenth; victory off Cape La Hogue (1692); defeats at Steinkirk and Landen (1692); capture of Namur (1695); treaty of Ryswick (1697).

5. *Home Affairs.*—Plot for assassination of king (1696); reform of debased currency by Sir Isaac Newton; commencement of National Debt; Darien scheme.

6. *Legislation.*

1689. *Mutiny Act*, which practically gave the Commons power to disband the army if necessary.
Toleration Act. Freedom of worship allowed, under oath of allegiance, to all except Roman Catholics.
Bill of Rights, embodying terms of Declaration of Right.
1690. Settlement and appropriation of revenue—most important. Previously sums had been voted to monarchs, who spent them as they thought fit. Now special sums voted for special purpose, as at present.
1693. *Triennial Bill.*
1696. Act for the regulation of trial in cases of treason.
1701. *Act of Settlement*, settling the succession of primogeniture on condition of the sovereign being a Protestant.

G.—*School Management.*

Second Year.—Chap. i., *Scholarship School Management.*

Third Year.—The teaching of English.

In addition, one or two notes of lessons should be written each week. The notes should generally be divided into "Matter" and "Method"—the former containing all the facts to be taught, the latter simply the method of teaching those facts; but inductive lessons, like grammar and arithmetic, are best arranged in steps. Some lessons for infants may also be arranged as "conversational lessons." Students should send notes occasionally for criticism. In *all* cases, the time allowed, class for which intended, and apparatus employed, should be stated at the head of lesson.

H.—*Euclid.*

Second Year.—Definitions, axioms, and postulates.

Third Year.—Props. 27–30, and four deductions per week. Use Egan's *Exercises on Books I. and II.*

I.—*Algebra.*

Third Year.—Addition and subtraction; use of brackets; substitution of numerical values.

J.—*Music.*

First Year.—The major scale and its structure.

Second Year.—Transition to first sharp or first flat keys.

Third Year.—The structure of the minor scale and its relation to the major.

K.—*Physiography.*

All pupil teachers should read up this subject; it will help them both in their annual examinations and also at scholarship. Cartwright's *Physiography* (Section I.) adequately covers the ground, a detailed syllabus of which will be found in Schedule V. Lack of space prevents many notes on the subject, but I shall be glad to privately assist any student who meets with difficulties.

Test Questions.

1. Penmanship.
Large Hand:—*Self-denying Ordinance.*
Small Hand:—*Though the mills of fate grind slowly,*
Yet they grind exceeding small.

2. Write a brief essay on "The Difficulties a Pupil Teacher meets with in his Work."

3. Write notes of a lesson on "The Elephant," making a special feature of the adaptation of the structure to the mode of life.

4. Why is it warmer in summer than in winter? why are the days longer?

5. Multiply 39768 by 133112111 in three lines, and explain your process.

6. Mention any living authors whose books you have read. Which of them did you enjoy most?

7. Explain clearly the meaning of the following abbreviations, and say what the full words are for which they stand:—i.e., e.g., inst., prox., ult., J.P., M.A., Victoria D.G. Britt. Reg. F.D., MSS., Memo.

AUTUMN EXAMINATION, 1899.

Seventh Month—April.

WORK TO BE PREPARED.

A.—*English.*

First Year.—Prepare *Ode on the Spring*, verse 2.

Second Year.—Prepare fully lines 251–286 of *The Deserted Village.*

Third Year.—1. Learn twenty roots and meanings each week.
2. Prepare lines 240–280 of Pope's *Essay on Man*, Epis. IV.

(For Full Notes on Paraphrase, Parsing, and Analysis, see November Number, 1898.)

B.—*Arithmetic.*

First Year.

Boys.—Fractions with Recurring Decimals.

Girls.—Problems on Fractions and general problems.

Second Year.

Boys.—Problems on Stocks.

Girls.—General problems or back questions.

Third Year.—Work any general papers, and the following in the time allowed at the examination:—

Boys.

1. Establish a general method or rule for reducing a circulating decimal to a vulgar fraction.

Simplify $\left(\frac{4\cdot\dot{6}}{7\frac{1}{2}} \times \frac{19\frac{7}{12}}{9\cdot\dot{3}}\right) - \left(\frac{3\cdot\dot{5}}{4\cdot\dot{1}\dot{6}} \div \frac{2\frac{1}{3}}{3\frac{1}{2}}\right)$. Ans. $\cdot\dot{2}2\dot{6}$.

2. At what rate per cent. simple interest will £335 amount to £435, 10s. in 4 years? Ans. 7½ per cent.

3. An observer on the platform of a railway station noticed that a train passed him in 7 seconds, and that it passed completely through the station,

which was 396 yards long, in 25 seconds. How long was the train, and how fast was it moving? Ans. 154 yards long; 45 miles per hour.

4. Find to the fraction of a penny the true discount on £500, one moiety being due in 6 months and the other in 9 months, discount being reckoned at 5 per cent. per annum. Ans. £15, 2s. 8$\frac{2}{13}$d.

5. A man insured his life for £3500, at a yearly premium of £65. He died immediately after making his fourth annual payment. How much did the company lose by the transaction, if money was then worth 5 per cent. compound interest? Ans. £3219, 16s. 10$\frac{1}{2}$d.

6. A began business with £450 capital, and at the end of 4 months he took B into partnership with £300. Two months later they took in C with £500 capital, but 3 months afterwards C withdrew £250 from the concern. At the end of 12 months there was a profit of £502, 10s. to be divided among them. Find each partner's share of that profit. Ans. A £270, B £120, C £112, 10s.

Girls.

1. What is your method of dividing one decimal by another? Take as an example 8·046 divided by 14·9.

Simplify $\frac{\cdot285 \times \cdot002 \times 1\cdot8}{\cdot009 \times \cdot038}$. Ans. $\frac{\cdot54}{3}$.

(*N.B.*—Cancel before multiplying.)

2. Reduce £·64375 + ·025 of £1, 5s. to the decimal of ·675 of £2. Ans. ·5.

3. After paying 7d. in the £ income-tax, a person has £625, 18s. 10$\frac{1}{2}$d. What was his gross income? Ans. £644, 15s.

4. Find the value of ·83̇ of 13s. 4d. + ·13̇8̇ of £1, 4s., and express the result as the decimal of £13. Ans. ·05.

5. Equal quantities of tea which cost 2s. and 1s. 8d. per lb. respectively are mixed and sold for 2s. 2d. per lb., at a total profit of £3. How many lbs. were sold? Ans. 180 lbs.

C.—*Music.*

A set of questions should be worked each week.

D.—*Geography.*

India.—Boundaries, extent, physical features, productions, climate, industries, government, and chief towns.

(This is specially emphasised in the syllabus.)

Chief Points:—

Note the climate, especially the monsoons and their effects on the country; the sanatoria—Simla, Poona, Darjeeling, etc.

Productions.—Note extensive agriculture—rice, millet, pulse, indigo, jute, wheat, barley, oil seeds, poppy for opium, tea and coffee, timber, cotton and tobacco, and such fruits as pine-apple, melon, pomegranate, etc. Notice should be taken of the importance of the irrigation works and the railways.

Industries.—Mainly agriculture. Manufactures fall under two heads:—

1. *Domestic*—carpets, chintz, filigree work, ivory and wood carving, shawls, etc., in which much artistic skill is shown.
2. *Factory Manufactures*, as yet in infancy—cotton, jute, silk goods, beer.

Government.—1. In England. Secretary of State for India, aided by council of not less than ten, consisting of those who have resided ten years in India and are not in English Parliament.

2. In India. The Viceroy or Governor-General, aided by an executive council (seven in number), constituting the supreme government. Of this council there are extraordinary members and members for legislative purposes (about twenty).

British India is now divided into thirteen local governments and administrations: Madras and Bombay (under Governors), Bengal, NW. Provinces, Punjab (under Lieutenant-Governors), Burma, Assam, Central Provinces, Berar, Ajmere, Coorg, Beluchistan, and the Andaman Islands (under Chief Commissioners).

The provinces are divided into districts, of which there are about 250, under Collectors, Magistrates, or Deputy-Commissioners.

The native states have various degrees of independence, but a Resident is attached to each.

Imports and exports need careful attention, also the chief towns. Some account should be prepared of the various native races, their origin and religions.

E.—*History.*

The Civil War to the establishment of the Commonwealth.

Trace the causes leading to the outbreak of hostilities; the character of the opposing forces at the commencement of the struggle; the enormous influence exerted by religion on the Parliamentarians; the New Model; the part taken by the Scots; a map of England, showing the sites of the chief battles; the leaders on each side; the gradual shifting of power, first to the Independents, then to the army.

F.—*Euclid.*

Second Year.—Props. 21–24, Book I. Four deductions per week from Egan's *Exercises*.

Third Year.—Book I., Props. 7–14. Six deductions per week from Egan's *Exercises*.

G.—*Algebra.*

Simultaneous Equations, and general questions on the year's work.

H.—*Teaching.*

Second Year.—Chap. vii., *Scholarship School Management.*

Third Year.—Revise chaps. i.–iii., *Scholarship School Management.*

Test Questions.

1. Penmanship.

Large Hand:—*Appropriation of Supplies.*

Small Hand:—*Worth makes the man, and want of it the fellow.*

2. Write an essay on "The Value of Travel."

3. Paraphrase and analyse *all* the English set, and parse all words presenting any difficulty.

4. *First Year.*—(*a*) Write out the mental effects of the different notes of the scale. How may they be modified?

(*b*) Name the intervals made by each of the following notes with the others:—

d m l f e s.

Second Year.—Rewrite (*a*) in the "better" method, (*b*) in the imperfect method:—

(*a*) **l f e r s fe d' t l s fe m fe s.**

(*b*) **d m r 'd m f t, r m l t d'.**

Third Year.—Explain and write the three forms of the minor scale.

5. Describe with a sketch map the mountain system of Asia.

6. Describe the course of the Ganges.

7. Into what regions would you divide Asia to explain to a class the vegetable productions?

8. Write out a list of the countries comprising Asia, with the chief towns.

9. Describe a coasting voyage from Calcutta to Hong-Kong.

10. Trace the descent of James the First of England, and show what relation he was to Lady Arabella Stuart.

11. What was the Hampton Court Conference, and what were its results?

12. Trace the growth of Parliamentary power under James the First and Charles the First.

13. Give a brief summary of the chief opinions held by James the First. Show how he tried to enforce them, and with what results.

14. What were the circumstances leading to the Petition of Right, and what were its provisions?

15. What Parliaments are known as "Short" and "Long"? Trace the changes in the constitution of the latter.

16. What was "ship-money"? Explain Hampden's objection to pay it.

17. *Boys* (*Second Year*).—The three medians of an equilateral triangle are equal.

(*Third Year*).—Construct a square of which the diagonal is given.

18. (*Third Year*).—A certain number is diminished by 7, and it is found that $\frac{1}{4}$ of the remainder is greater than $\frac{1}{4}$ of the original number by 1. What is the number?

19. *Girls* (*Second Year*).—Explain how you would improve the spelling of a class which was weak in that subject.

20. (*Third Year*).—Write notes for a Lesson on Thrift for the upper standards.

SCHOLARSHIP COURSE FOR DECEMBER 1899.

1. *Reading.*—Ten minutes' practice per diem, as often as possible before a competent critic. Read at least one of Scott's novels per month.

2. *Writing.*—Take a few minutes' daily practice from copy book (*Practical Teacher Copy Book*, 1s.). Continual care must also be exercised.

3. *Repetition.*—Twelve or fifteen lines weekly till the whole is known.

4. *Composition.*—Continual care and practice. Send up an essay each month for criticism and advice. Read up your subject if necessary. In any case think it well over, and sit down to write what you have thought, and not to think what you will write. Always arrange a draft plan or analysis. Write one or two essays each week, selecting from the following:—Description of an English Cathedral; Criticism of some book you have read; Arctic Exploration; "Sweet are the uses of adversity;" Warfare, Ancient and Modern; The Influence of Climate on Character; Dress as an Evidence of Character; "A rolling stone gathers no moss."

5. *English Language and Literature.*

(1.) Learn twenty roots and meanings each week.

(2.) Prepare the grammar of the verb.

This will demand considerable attention. Learn exact definitions of all the terms employed—Regular and Irregular, Strong, Weak, Transitive, Intransitive, Mood, Tense, Voice, etc. These must be learned verbatim from a reliable text-book. The following are some of the points which require especial attention:—

(*a*) The *Subjunctive Mood.* "The Subjunctive Mood comprises those forms of a verb which are used when a statement or supposition has relation to an event or state of things which is only *thought of*, and which is not treated by the speaker as a *matter of fact*." It does not include mere condition—for example, "If it rains, I shall stay at home": "rains" is indicative conditional. It *is* raining or not; but, "If it were to rain for a whole year" is in the Subjunctive Mood, because the state of things is not treated as a matter of fact, but merely as a hypothesis. Or again, "Though he *slay* me, yet will I trust him" is subjunctive; but, "If he kills me," etc., is not. Some care will be necessary to distinguish the conditional

indicative from the subjunctive, especially as the tendency of modern speech is to use the former when the latter is more correct.

(*b*) The uses of the *Infinitive*.

(*c*) The *Gerund*, which may be defined as "a substantive formed from a verb by the suffix *-ing*, and which, if formed from a transitive verb, has the governing power of the verb."

(*d*) The *Number* of the verb when there is more than one subject. For example,—

The boy and girl	*are*.
The boy or girl	*is*.
The boys or girls	*are*.
The boy or girls	*are*.
The boys or girl	*is*.

The last two should be avoided in composition.

(*e*) The *Defective* and *Anomalous* verbs—most important.

Distinguish uses of *shall* and *will*, *may* and *might*, as auxiliaries and as principal verbs: *can* is not an auxiliary, nor are *wit*, *dare*, *methinks*, *meseems*, *melists*, *worth*, *hight*, *need*, *dight*, etc.

Do as an auxiliary of emphasis, and as merely helping to form the indicative mood.

If these are cleared up, many difficulties in parsing and analysis will disappear.

(3.) *Literature.*—Pp. 116–154, Collier's *History of English Literature*: Sir Philip Sidney, Edmund Spenser, Richard Hooker, the English Bible, William Shakespeare, Sir Walter Raleigh.

Spenser's *Faerie Queene*, written in archaic language and in a stanza which was his own invention, has proved a source of inspiration to many writers since. The gorgeous imagery, the wealth of epithets, the easy diction, have made him a "poets' poet." The *Faerie Queene* is a double allegory—(*a*) the contest between right and wrong in the abstract, and (*b*) the political contest of Protestantism and Roman Catholicism. Hooker, in his *Ecclesiastical Polity*, was the first master of English *prose*, the possibilities of which had never been appreciated. Shakespeare the poet and dramatist, whose skill and power is recognised not only where the Anglo-Saxon speech is heard, but also amongst all civilised nations, is a life's study in himself, and the student can hardly hope to do more than learn the few scanty facts we know of his private life and a list of his works. One or two should be read, but each is capable of years of study, and reveals new beauties at each search.

(4.) Prepare lines 500 to the end of Cowper's *Task*, Book IV. Make sure of all analysis and parsing, and write for assistance if in difficulties.

6. *Arithmetic.*—Christian and Collar, chaps. xxxiii., xxxiv., xxxv.: Partnership and Averages. The exercises 90 and 91 should be worked, or the student should satisfy himself that he *can* work all. Send up any for solutions which present difficulty.

7. *Algebra.*—Hall and Knight, chap. xxii. (Miscellaneous Fractions). Work as many of the examples as possible.

8. *Euclid.*—Props. 30–36, Book I., with twenty exercises from Egan's *Exercises*.

9. *Geography.*

(*a*) New Zealand, and towns and government of Australia.

(*b*) Revise Holland and Belgium, Denmark and Scandinavia.

(*c*) Practise memory maps. (Use *Methodic Memory Maps*, 1s., Office of THE PRACTICAL TEACHER.)

Data on New Zealand.

Population 800,000. Sovereignty of the islands ceded to Great Britain in 1840 by treaty at Waitangi; native chiefs guaranteed the possession of their lands, forests, etc.

Seat of government fixed at Auckland, but removed to Wellington in 1865.

Productions—Kauri pine (much valued), native flax, wool, tallow, gold mining, rich iron ore in Taranaki, coal and copper.

Exports—Wool, frozen meat, agricultural products, gold, kauri gum, tallow, timber, etc.

Imports—Apparel, cotton piece goods, drapery, boots and shoes, hosiery, iron and steel, machinery, woollens, etc.

General Government.

(1.) Governor, aided by Ministry.
(2.) Legislative Council of 46 (elected for seven years).
(3.) House of Representatives of 74 (elected for three years).

Chief Towns—Wellington, Auckland, Dunedin, Christchurch, Invercargill, Napier, Nelson, Oamaru.

Note also the "wonderland" of the North Island, and the Maoris.

10. *History.*—Henry the Fourth to Richard the Third.

Chief Points:—

Henry IV.

(*a*) Nature of Henry's claim. Accepted by Parliament.
(*b*) Revolts—(i.) By Earls Huntingdon, Kent, Salisbury (1400).
(ii.) By Owen Glendower, joined by the Percies (1400-1410).
(iii.) By Percy, Mowbray, Scrope (1407).
(iv.) Earl of Northumberland (1408).
(*c*) Advance of the constitution under the Lancastrians. Henry, elected by Parliament, was in a measure bound to yield to Parliament. Hence freedom of speech in Parliament was affirmed. Redress of grievances before supplies. Money proposals not to be altered by the Lords, etc.
(*d*) Lollards and *De Heretico Comburendo*.

Henry V.—The French War.

Henry VI.

(i.) Minority under Bedford. Divisions and jealousies of nobles. Gradual loss of French possessions. Joan of Arc.
(ii.) Jack Cade's revolt and the "complaint of the Commons of Kent," directed against the Suffolk party, caused by loss of French possession, interference with elections, heavy taxation, etc.
(iii.) The rival claims of the Yorkists and Lancastrians. Prepare a genealogical table to show this.
(iv.) The course of the Wars of the Roses in the reign.
(v.) Causes of the fall of Lancastrians—(*a*) Want of success abroad; (*b*) weakness of government at home; (*c*) want of economical management of finance; (*d*) unpopularity of the queen; (*e*) general desire for a strong government.

Edward IV.

(i.) Connection with the Nevilles.
(ii.) Struggle between the king and Warwick, and consequent resumption of war. Battles and events in the war.
(iii.) Character of Edward the Fourth and his government. Benevolences.

Edward V. and Richard III.

Richard's intrigues for power. Probable murder of his nephews. Arrangements for marriage. Landing of Henry Tudor, and Battle of Bosworth.

Effects of the Wars of the Roses must be carefully noted.

(i.) The baronage had become impoverished, reduced in numbers, demoralised.
(ii.) The old feudal system practically abolished, and a new nobility created.
(iii.) The dawn of a new era in history. The passing away of the Dark Ages.
(iv.) Growth of pauperism owing to the introduction of sheep-farming on a large scale and the breaking up of military households.
(v.) The nearly absolute rule of the Tudors.

11. *Theory of Teaching.*—Chap. iv., *Scholarship School Management*.

12. *Spelling.*—One hundred words per week from *Words commonly Misspelt*.

13. *Domestic Economy.*—Clothing. Articles used, relative value and cost of each, best methods of preserving; modern dress in relation to hygiene.

14. *Music.*—Chap. iv., *School Music Teacher*.

15. *French.*—Next four pages of *Le Trésor*. Grammar of the verb.

16. *Physiography.*—Chap. viii., Gregory.

17. *Freehand.*—One or two copies each week. Send up one occasionally for criticism.

Test Questions.

1. Penmanship.
Large Hand:—*Natural History.*
Small Hand:—*A pleasing land of drowsy head it was,*
Of dreams that wave before the half-shut eye.

2. Notes of Lesson on Animals of the Cat Kind, the Changes in the Life of a Moth, Simple Proportion, the Crusades.

3. The *Task*, Book IV.

(*a*) Analyse lines 513-522.
Parse *would*, *times*, *Sidney*, *it seems*, *all*.
(*b*) Analyse lines 659-670.
Parse *like a flower*, *it*, *only*, *contracts defilement not to be endured*.
(*c*) Analyse lines 691-699.
Parse *which*, *more*, *not once*, *but*, *hope of being free*.
(*d*) Analyse lines 731-743.
Parse *man*, *infused*, *though*, *each from each*, *so much*, *more exact*.

4. Account for the sudden development of English literature in the fifteenth century, and mention the chief writers.

5. Say what you can of the *native* fauna and flora of Australia.

6. Enumerate the countries forming the Balkan Peninsula; mention the capitals, forms of government, and their mutual relations.

7. Write what you can of Edward the First's judicial reforms, and the principal statutes passed during his reign.

8. Trace the causes leading to the Villeins' Revolt. (Events during the same not required.)

9. What is meant by Induction and Deduction? Give examples.

10. Whence do we obtain our chief supplies of preserved foods? What dangers arise from eating those improperly preserved?

11. What are "mental effects" of various notes? How may they be modified?

CORRESPONDENCE: RULES.

To ensure an answer in the next issue, queries must be sent by the 15th of each month.

Name and address of sender, with coupon of current number of THE PRACTICAL TEACHER (and *nom de plume* if desired), must be enclosed.

As a rule, all replies will appear in the Correspondence Column; but any one desiring an immediate reply may obtain it by enclosing a stamped addressed envelope.

All communications and queries with regard to the PUPIL TEACHERS' AND SCHOLARSHIP COURSE should be addressed to "A. T. FLUX, The Bays, Belvedere, Kent."

ANSWERS TO CORRESPONDENTS.

Anxious.—You will have to take the Drawing and Science papers at next Scholarship Examination if you wish to secure marks. Previous successes will not count.

H.J.R.—Your essay is lacking in thought and arrangement. The ideas are not much above an ordinary schoolboy's. No attempt has been made to arrange or classify them. Marks, 20/60.

A.G.M.—Any daily newspaper will tell you, if you consult the shipping advertisements.

N.E.—You can hardly hope to pass successfully if you do neglect compulsory questions.

Algebra.—If the sum of the coefficients in the odd places (1, 3, 5, etc.) is equal to the sum of the coefficients in the even places, the expression will divide by $x + 1$, if equal; but with different signs (that is, if the sum of the coefficients is equal to 0), by $x - 1$.

(All other correspondents answered by post.)

REPLIES TO SCIENCE QUERIES.

(See also page 604.)

A.W.B.—(*a*) A cylindrical piece of glass, whose index of refraction is $\frac{3}{2}$, has two hemispherical ends, each of radius a. Find its length, in order that a parallel beam of light, incident on one end, may emerge as a parallel beam from the other.

R. U. I. (Second Arts).

The nature of this problem demands that the spherical ends of the glass cylinder should be convex. If this were not so, a solution could not be obtained without a knowledge of the diameter of the cylinder.

When light is emitted from a point O in a vacuum (see Figs. 1 and 2, answer to "Light"), at a distance u from the curved surface of a dense medium, the distance v from that surface to the resulting image is given by the equation

$$\frac{\mu}{v} - \frac{1}{u} = \frac{\mu - 1}{R},$$

where μ is the refractive index of the dense medium, and R is the radius of curvature of its surface. Note that u, v, and R are taken as positive when the distances which they represent are measured from the surface in a direction opposite to that pursued by the incident light (from left to right in Figs. 1 and 2 above), negative values corresponding to distances measured in the reverse direction.

For parallel light we must suppose that the luminous object is at an infinite distance—that is, $u = \infty$, and $\frac{1}{u} = 0$. In this case the distance of the image is obtained from the equation

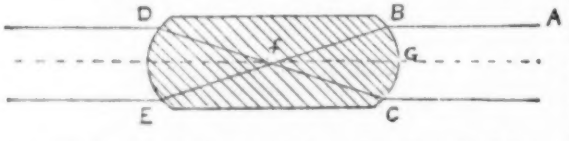
$$\frac{\mu}{v} = \frac{\mu - 1}{R}; \quad \therefore v = R\,\frac{\mu}{\mu - 1}.$$

In the case of the glass cylinder, the ends being convex, $R = -a$.

$$\therefore v = -a\,\frac{\mu}{\mu - 1} = -a\,\frac{\frac{3}{2}}{\frac{1}{2}} = -3a$$

—that is, the image will be at a distance $3a$ from the surface inside the glass.

Now it is a fundamental property of light that a ray can retraverse its path. Hence, in the Fig., if a ray of light, AB*f*,



passes through the focus at *f*, then a ray, *f*B, emitted from *f* will afterwards traverse the path BA. Hence light emitted from the focus *f* will be reduced to parallelism on emerging from the face BC.

Finally, if the hemispherical end DE of the cylinder is at a distance from *f* equal to that of the end BC, the light, after passing through the focus *f*, will be again reduced to parallelism at the face DE.

Therefore total length of cylinder $= 2 \times fG = 2r$. But the numerical value of $v = 3a$.

∴ In order that the conditions specified in the question should be complied with, the length of the cylinder must be equal to $6a$.

(*b*) If the focal length of a glass lens be six feet in air, what will be its focal length in water?

(Refractive index of glass $\frac{3}{2}$; refractive index of water $\frac{4}{3}$.)

The focal length, F, of a lens is given by the equation

$$\frac{1}{F} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right).$$

(For meaning of symbols, etc., see answer to "Light.")

In passing from water to glass we must take

$$\mu = \frac{\text{velocity of light in water}}{\text{velocity of light in glass}}.$$

Let μ_g represent the refractive index of glass. Then

$$\mu_g = \frac{\text{velocity of light in vacuum}}{\text{velocity of light in glass}}.$$

Similarly, if μ_w represents the refractive index of water, we have

$$\mu_w = \frac{\text{velocity of light in vacuum}}{\text{velocity of light in water}}.$$

$$\therefore \mu = \frac{\text{velocity of light in water}}{\text{velocity of light in glass}} = \frac{\mu_g}{\mu_w} = \frac{\frac{3}{2}}{\frac{4}{3}} = \frac{9}{8}.$$

∴ The focal length, F_w, of the lens in water is given by

$$\frac{1}{F_w} = \left(\frac{9}{8} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = \frac{1}{8}\left(\frac{1}{R_1} - \frac{1}{R_2}\right).$$

The focal length, F_a, of the lens in air is given by

$$\frac{1}{F_a} = \left(\frac{3}{2} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = \frac{1}{2}\left(\frac{1}{R_1} - \frac{1}{R_2}\right).$$

$$\therefore \frac{F_w}{F_a} = \frac{\frac{1}{2}}{\frac{1}{8}} = 4.$$

Hence, since $F_a = 6$ feet, $F_w = 4 \times 6 = 24$ feet.

The London County Council Natural History Reading-Room.—Mr. S. Prout Newcombe has offered to the Natural History Reading-Room of the London County Council his educational collection of natural history specimens and literature. The collection, which is valued at about £3,000, consists of about 21,000 objects, with a considerable mass of literature on natural history subjects, all classified to correspond with the examples, and is of special value to teachers, the arrangement being that of an illustrated catalogue. The draft deed of gift to the Council contains the following provisions:—1. The collection is to be kept and exhibited always in a room to be named "The Natural History Reading-Room," which room is to be maintained in good order at the expense of the Council; and the collection is to be kept separate and distinct from other than natural history objects and literature. 2. The collection is to be transferred to the council for educational purposes, and not as a public exhibition. 3. Before the end of the present year the collection is to be removed temporarily to the Shoreditch Technical Institute, and within a certain period to be transferred to a suitable place in the county of London.

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Bacteria and Fluorescence.—Mr. Jordan has lately been endeavouring to discover the conditions under which fluorescence is produced, and especially the nature and amount of the chemical substances essential to the formation of the fluorescing body. Among the bacteria chosen for this purpose were *B. fluorescens*, *B. tenuis*, *B. mesentericus*, *B. putridus*, which do not liquefy gelatin; also *B. viridans* and *B. fluorescens liquefaciens*, which do liquefy gelatin. It seems that while phosphorus and sulphur are essential to the formation of the fluorescing pigment, the nature of the base with which these elements are associated is not important. The fluorescigenic function may depend on the molecular constitution of the compounds employed. Thus, *ceteris paribus*, the presence of the methyl or methylene group is coincident with superior nutritive value and fluorescigenic power. The presence of acid in the medium conceals the presence of the substance to which the colour is due, and interferes with those vital activities of the bacilli which in an alkaline solution lead to its production. Diffuse daylight is unfavourable to pigment production. Since the pigment is of no discoverable advantage to the organisms by which it is produced, its production is probably incidental, and not an essential vital act.

OUR NEW CERTIFICATE COURSE FOR 1899.

BY GEORGE COLLAR, B.A., B.SC.,
Head-Master of the Stockwell Pupil Teachers' School.

TEST QUESTIONS ON THE MARCH WORK.

Theory of Teaching.

First Year.—1. Under what heads would you criticise a lesson given by a pupil teacher in your school?

2. Write notes of a reading lesson to Standard V.

3. What is a *sorites?* Construct one of three premises, and resolve it into the distinct syllogisms to which it is equivalent.

Second Year.—1. Explain the steps by which a general notion or concept is formed, and distinguish between distinct and indistinct concepts. How far does the choice of examples by a teacher assist the pupils in forming distinct and accurate concepts?

2. What do you mean by abstraction? What faculties are concerned in the process?

Arithmetic.

1. Explain the terms—ratio, proportion, inverse ratio, duplicate ratio.

2. Show that if a, b, c, and d are whole numbers, such that a and b are prime to one another, and $a : b :: c : d$, then c must be a multiple of a, and d a multiple of b.

3. How many lbs. of chicory, at 5d. per lb., must be mixed with 20 lbs. of coffee, at 1s. 3d. per lb., to reduce the price of the mixture to 1s. 1d. per lb.?

Theory of Music.

Both Notations.—1. Give the meaning of *da capo, dal segno,* M 80, *crescendo poco a poco.*

2. Give an account of the different forms of the minor scale.

English.

First Year.—1. Distinguish carefully between a possessive pronoun and a personal pronoun in the possessive case, and between a reflexive and an emphatic pronoun.

2. What are indefinite pronouns? Give a list of them.

Both Years.—Give the original and modern meanings of the word "humour." In what sense does Addison use the word? Mention some of the "humours of fashion."

Second Year.—1. Give a short summary of the Fifth Act of *King Lear.*

2. Illustrate Professor Dowden's remark that "Lear is the greatest sufferer in Shakespeare's plays."

Geography (both years).

1. Compare the climate of New Zealand with that of Great Britain.

2. Give an account of the native inhabitants of New Zealand.

3. Give a short sketch of the history of New Zealand.

English History (both years).

1. Give an account of Danby, dwelling particularly on his foreign policy and his church policy.

2. What are the chief clauses of the Habeas Corpus Act?

3. What attempts were made during the lifetime of Charles the Second to exclude his brother James from the throne?

Algebra.

Men—First Year.—1. Prove that every quadratic expression, as $ax^2 + bx + c$, can be resolved into two factors. What must be the relations between a, b, and c in order that each factor may be rational?

2. If p and q are the roots of the equation

$$ax^2 + bx + c = 0,$$

show that $p + q = -\frac{b}{a}$, and $pq = \frac{c}{a}$.

Geometry.

Women—First Year.—1. The angles at the base of an isosceles triangle are bisected by straight lines which meet within the triangle; show that the triangle formed by the base and these two lines is isosceles.

2. Prove that the diagonals of a square bisect one another.

Men—First Year.—1. The arcs intercepted between two parallel chords are equal.

2. Draw two tangents to a given circle which shall contain an angle equal to a given angle.

Men—Second Year.—1. Inscribe a circle in a given sector of a circle.

2. Prove that if an equilateral triangle and a regular hexagon be inscribed in the same circle, the square on the side of the triangle is three times that on the side of the hexagon.

Latin.

Both Years.—1. Explain what is meant by the term *objective genitive,* and say what is the difference between the *ablative of quality* and the *genitive of quality.*

2. Explain the following constructions:—

(*a*) *Ad neglegendas leges.*

(*b*) *Qui se ipse jam dignum custodia judicavit.*

(*c*) *Superiora illa, quamquam ferenda non fuerunt, tamen, ut potui, tuli.*

3. Why is *ipse,* and not *ipsum,* used in (*b*)?

Second Year.—Translate, and write full notes of explanation on:—

Macte nova virtute, puer: sic itur ad astra, dis genite et geniture deos.

French.

Both Years.—1. Give a list of the chief verbs that govern the infinitive without a preposition.

2. Translate and explain:—

(*a*) *Je le donne en quatre au plus hardi.*

(*b*) *Je m'attache hardiment aux plis de la robe flottante du sublime aveugle d'Albion.*

(*c*) *Une faiblesse que je me suis souvent reprochée.*

SYLLABUS AND HINTS FOR APRIL.

Theory of Teaching.

First Year.—1. Kindergarten training and general methods of teaching infants. This is of the utmost importance to infant teachers, and forms a very interesting and useful study for all. It may be combined with revision of back work. There are several books on the subject of kindergarten; among them we may mention the *Kindergarten Guide,* by Loïs Bates (Longmans, 6s.), and *Practical Kindergarten Lessons,* by Mrs. Mortimer (Nelson, 2s. 6d.).

2. *Logic.*—On fallacies, logical fallacies, and material fallacies. This is an extremely important though not difficult part of the subject. Study carefully Jevons, xx., xxi., and Cartwright, xviii.

Second Year.—*Judgment and Reasoning.* A judgment is a statement resulting from the comparison of two or more things. Thus, two ideas, either of single things or of groups, occur to our mind, and we assert a relationship between them; for example,—

This man is my brother (two single things).
Lions are carnivorous animals (two groups).
Fido is a dog (one single thing and one group).

Judgment, thus, may involve perception or conception, or both; and ability in this process springs from the employment of the correct *mode* of perceiving or of conceiving. By this we mean the seizing upon the right characters of the thing or group. Thus, when we think of lions and of carnivorous animals, a vast number of characters are associated in our minds with lions; but in order to *judge* well, we must be able to pass by all of them except such as are common to all carnivorous beasts; then we see that the term "carnivorous beasts" includes lions, and we make our judgment.

A judgment that is arrived at without intermediate steps is called an *intuitive judgment*—for example, Snow is white. But if we have a possibility of making a judgment in the other sense, our judgment is called a *deliberative judgment.* Thus, ask a child what a lobster is, and he may say, "A lobster is a fish." He is tempted to make this statement because a lobster is sold at the fishmonger's, and he may also know that the lobster breathes by means of gills. But if he is aware that all fish are vertebrates, and a lobster has no backbone, he will deliberate, and then arrive at the judgment, "A lobster is not a fish."

Judgments are also classed as analytic and synthetic.

Importance of training the judging powers of children.

Reasoning proceeds through abstractions. It must be carefully distinguished from mere associative trains of thought.

Study the two principal modes of reasoning—namely, induction and deduction. Importance of induction in education. Relation between deduction and the syllogism. Refer to last month's work, and note: reasoning from analogy—instances, types, etc.; when such reasoning is valid, and when not.

Arithmetic.

Percentages.—The simpler rules in percentages call for no special comment. Remember that a percentage is a "fraction," and hence to find a certain percentage of a given quantity is simply to take that fraction of it whose numerator is represented by the rate, and denominator by 100. Attention should be paid to "covered insurance," in which goods are insured for more than their real value, in order that the value of the goods *and the premium* may be recovered in case of loss. Thus, if the rate be 5 per cent., a person who had paid £5 premium would receive £100 in case his goods were lost; and as this is equal to the premium (£5) and the value of the goods, the goods are evidently worth £95. Hence, the person insures every £95 worth of goods as though worth £100, and pays a premium of £5 on every £95, instead of on every £100, in the actual value of the goods.

Simple interest involves time as well as rate per cent. The most common error in this rule arises from taking the amount as proportional to the time. This, in its turn, arises from confusing proportion with simple increase.

Quantities *may* be so related that an increase in one causes an increase in the other without being in proportion. Thus, if money is put out at interest, the greater the length of time the greater the amount; but yet the amount of a sum at the end of *two years* will not be *twice as great* as the amount at the end of one. The explanation is, that the amount at the end of one year consists of two parts—the principal, and the interest for one year; and it is only the latter which changes with the number of years, the principal remains fixed. Similar considerations apply to the relation between amount and rate per cent.

The time, rate, principal, or amount may, when the others are given, be found by means of formulæ; but the student must guard against any mechanical use of the formulæ: it is better to reason each sum out.

Compound Interest.—This rule affords a striking illustration of the advantage of a decimal coinage. Always work in decimals of a pound, and never carry beyond three places: the third place (£·001) represents an amount smaller than a farthing, and in practice bankers never take account of anything less than a penny.

Music.

Both Years.—Although not required of first year candidates, all students are advised to pay careful attention to the question of the compass and training of the different voices. This subject is exciting a great deal of attention among school authorities at present. All students are recommended to read *How to Train Children's Voices*, by T. Maskell Hardy (Curwen, 1s.); and those who care to go more fully into the matter should read *Hygiene of the Vocal Organs*, by the late Sir Morell Mackenzie (Macmillan).

English.

First Year.—Study fully the grammar of adverbs, prepositions, conjunctions.

Origin of adverbs:—(*a*) From oblique cases of nouns. Thus from the genitive—*needs* (= of need or of necessity), *once*, *always*; dative—*seldom*; accusative—*home*, *day* and *night*, *meanwhile*. (*b*) From adjectives. The usual way in Modern English is to add *-ly* to adjectives, just as adjectives are formed by adding *-ly* to nouns. In Early English, however, adverbs were formed by adding *-e* to adjectives—for example, *fæger* = fair, *fægere* = fairly; but since *-lic* was added to form adjectives, this suffix + *-e* came to be regarded as adverbial. Notice that if the adjective ends in the suffix *-ly*, it is very unusual to add a second *-ly* to form an adverb from it; in such words as *sly* and *holy*, the *-ly* is not a suffix, hence we say *slily*, *holily*.

Note the frequent use of unchanged adjectival and prepositional forms as adverbs.

Origin of prepositions:—(*a*) From nouns—*beside*, *across*. (*b*) From adjectives—*below*, *between*. (*c*) From verbs—*except*, *concerning*.

Compound prepositions—as, *in spite of*, *on board*; to these the term "prepositional phrase" may fairly be applied, since they take the place of a preposition. Phrases should always be named after the parts of speech in place of which they are used—a noun phrase is one that takes the place of a noun, etc.; and the student will see, therefore, that phrases which enlarge the subject of a sentence are adjectival phrases, and not prepositional phrases, although some text-books wrongly call them so.

Conjunctions, classified according to form as simple and compound, and according to use as co-ordinative and sub-ordinative conjunctions. Considerable light is thrown on the origin of conjunctions by the word *that*, which was used in Old English with conjunctions: thus, if we start with two sentences, "John wrote his letter," and "I left the room after that," the word *that* is a demonstrative pronoun, governed by *after*. But if we transpose the sentences—"I left the room after that John wrote his letter"—the emphasis disappears from the words *after that*, which now merely join the sentences; and in modern English *that* disappears altogether. We might almost consider *after* as a preposition governing a noun sentence; although, as it imparts an adverbial force to the sentence, we prefer to consider the sentence as an adverbial sentence, joined to its principal one by the conjunction *after*. In colloquial English it is often difficult to decide whether such words are prepositions or conjunctions.

> "So take a few promiscuous hints
> To warn you in advance,
> *Of* how a little English girl
> Will perhaps be served in France."
> T. Hood.

Both Years.—Selections from Addison, p. 321 to the end. This last section includes some of the most interesting of the essays.

Second Year.—Revise *As You Like It* by reading it through and preparing sketch of the plot.

Geography (both years).

Revise the British Possessions in Europe, and those in South-West and in East and South-East Asia.

The British East Indies include British Borneo and Labuan.

Draw a sketch map of Borneo; read the general geography of the island, and note its exact position. The Dutch hold rather more than two-thirds of the island—the remainder, over which a British protectorate has been established, belonging to the Sultan of Bruni, the Rajah of Sarawak, and the British North Borneo Company. Labuan is an island off the north-west coast of Borneo; the administration of this colony was transferred (1890) from the Colonial Office to the British North Borneo Company.

British North Borneo and Bruni include the northern part of the island. The soil is rich, and produces rice, sago, sugar-cane, coffee, pepper, tobacco, bees'-wax, camphor, gum, and timber. Edible birds' nests forming an important product here, as well as in Labuan, are sent in large numbers to China.

Sandakan, the headquarters of the administration, and Gaya, on the west coast, are the chief places.

Sarawak.—Read account of Rajah Sir James Brooke's work in Sarawak. The products are similar to those of British North Borneo. Kuching is the chief town.

Labuan lies six miles off north-west coast of Borneo. It has a fine harbour and large coal-measures. Sago, an important product, is exported to Singapore.

Hong-Kong.—Note the great trade of the capital, Victoria, one of the busiest ports in the world.

China and Britain.—1. In June 1898 China granted England a lease (for ninety-nine years) of the Hinterland of Hong-Kong (about two hundred square miles), including the most important part of Mirs Bay, together with some islands which were much needed for the development of Hong-Kong and its trade. Kanling, which lies within the leasehold territory, remains under the jurisdiction of China.

2. Wei-hai-wei, on the Shantung Peninsula, facing the Russian naval station of Port Arthur, was handed over to England (May 24th, 1898).

3. China conceded to British subjects the right of making a railway, and declared:—

(1.) That she will never alienate territory in the provinces adjoining the Yang-tse-kiang to any other power.

(2.) That while British trade predominates in China, the control of the maritime customs shall be left in the hands of an Englishman.

When did (*a*) Gibraltar, (*b*) Malta, become parts of the British Empire? Explain concisely their *value* to England.

What are the Straits Settlements? Why are they so called? Which is the most important commercially? Describe the trade of these settlements.

Which parts of Indo-China are British possessions? Describe the products and trade of Burmah. How is the trade being developed on the north-east side?

State carefully the importance of Hong-Kong to the mother country. What other territory has England acquired in China?

History.

Both Years.—Reign of James the Second.

This reign is a short one to prepare, and presents no special difficulties. The illegal acts of James should be carefully tabulated. The student who reads the account of this reign given by Macaulay will find himself well repaid.

Algebra.

Women.—Study the chapter on simultaneous equations. Notice that if there are two unknown quantities in one equation, we could not determine their respective values; for we might assume any value we pleased for one unknown, and we should obtain a corresponding value for the other. The case is different, however, when the same quantities occur in another equation which expresses a different relation between them from that in the first. We find that a similar consideration applies to equations with three or more unknown quantities. So, speaking generally, we say that there must be as many independent equations as there are unknown quantities.

The student will find that there are three different methods of solving simultaneous equations. We will take as our illustration—

$$\begin{cases} x - y = 3 & \ldots\ldots\ (1). \\ 7x + 9y = 5 & \ldots\ldots\ (2). \end{cases}$$

First Method.—Multiply the equations by such numbers as will make the coefficients of one of the unknown quantities the same in both cases. (It is better to select the unknown with the smallest coefficients, or those whose L.C.M. is most easily found.) Here multiply (1) by 7, leaving (2) alone.

$$\begin{cases} 7x - 7y = 21 & \ldots\ldots\ (3). \\ 7x + 9y = 5 & \ldots\ldots\ (4). \end{cases}$$

Subtracting (3) from (4), $16y = -16$,

$$\therefore y = -1.$$

Substituting this value in (1), we have $x = 2$.

Second Method.—Find the value of one unknown in terms of the other in one equation, and substitute this value in the other equation.

Thus from (1) we have $x = 3 + y$. Substituting in (2), we have $7(3 + y) + 9y = 5$, an equation with only one unknown, from which we find y, and thence x.

This method is generally the quickest when the coefficient of one unknown is 1.

Third Method.—Find the value of one unknown in terms of the other from each equation. These two values will evidently be equal, and the statement of this equality gives an equation with one unknown. Thus—

From (1), $x = 3 + y$.

From (2), $x = \dfrac{5 - 9y}{7}$.

$$\therefore 3 + y = \frac{5 - 9y}{7}.$$

From this we find $y = -1$, and $\therefore x = 2$.

Work plenty of examples, using all three methods. The great thing is to tell at a glance which method will be the quickest to solve any given equation.

Men—First Year.—Quadratic equations with two unknown quantities. There are several ways of solving such equations, and great judgment may be shown in selecting the best way.

1. When one equation consists entirely of quantities of the first degree, it is best to find the value of one unknown in terms of the other from this equation and substitute this value in the quadratic; for example,—

$$\begin{cases} x + y = 7 & \ldots\ldots\ (1). \\ 2x^2 - xy + 3y = 29 & \ldots\ldots\ (2). \end{cases}$$

From (1), $x = 7 - y$. Substituting this in (2),

$$2(7 - y)^2 - (7 - y)y + 3y = 29;$$

that is, $98 - 28y + 2y^2 - 7y + y^2 + 3y = 29$,

or $3y^2 - 32y + 69 = 0$.

Factorising $(y - 3)(3y - 23) = 0$,

$$\therefore y = 3 \text{ or } 7\tfrac{2}{3},$$

and from (1) $x = 4$ or $-\tfrac{2}{3}$.

2. When both equations consist entirely of terms of the second degree, it is best to determine the ratio between x and y first.

Mensuration.—Parallelograms and triangles—all cases.

Second Year.—Revise proofs, and work miscellaneous examples on the work in algebra.

Mensuration.—Revise the various cases of the rectilineal figures and circle, including chords, sectors, and segments; the rules for the latter are based mainly on Euclid, Book III.

Geometry.

Women.—Revise to the end of Prop. 15, and work exercises given in the text-book.

Men—First Year.—Revise to the end of Book III., and work exercises given in the text-book.

Men—Second Year.—Revise Book VI. 1-8, with exercises.

Latin.

Both Years.—Careful study of the "Uses of the Genitive Case." Notice that the general purpose of the genitive is to limit some word much in the same way as an adjective does. It is said to *depend* on this word, and may be related to it in one of two ways; hence we have subjective genitive and objective genitive. If for the phrase in which the genitive occurs we substitute another in which the word on which the genitive depends is replaced by a verb, the genitive will have to be replaced by either a subject or an object of this verb—for example, *hominum timor mortis* would become *homines mortem timent*; hence we should describe *hominum* as a subjective genitive, and *mortis* as an objective genitive.

The genitive is used to denote possession, quality, value, measure, plenty, or want. Notice the use of the genitive with *officium* understood: *Adulescentis est majores natu vereri.* Observe also the large number of legal expressions in which the name of the offence is put in the genitive after such verbs as *accuso, cito*; and adjectives *reus, innocens: damnare capitis* (or *capite*), "to condemn to death." The verbs *interest* and *refert* also take the genitive—for example, *interest reipublicae*; so do verbs of remembering, pitying, and forgetting.

Cicero, *In Catilinam*, to end of chap. viii.

It is taken for granted that all certificate students who are taking Latin are following the notes on this book given in The Practical Teacher Matriculation Course.

Second Year.—*Æneid*, ix. to the end.

French.

Both Years.—Syntax of the infinitive.

(*a*) Note that when the subject of the subordinate sentence in English is the same as that of the principal one, the infinitive is used—for example, "I believe I am right," *Je crois avoir raison*; but we say, *Je crois qu'il a raison.*

(*b*) The infinitive may also refer to the object of the principal verb: *Il m'a ordonné de venir.*

(*c*) It may replace an adjectival sentence: *Il entendait les oiseaux chanter*; instead of, *Il entendait les oiseaux qui chantaient.*

(*d*) It is often used in place of a finite verb in narrative poetry, the verb *commença* being probably understood. La Fontaine is particularly fond of this idiom: *Et le citadin de dire* (Bk. I., Fable 9).

(*e*) It is the part of a verb that is used as a noun.

Prepare *Le Voyage autour de ma Chambre* to end.

As soon as you have finished reading it through, get the edition published by The Practical Teacher Press, and begin revising, and make sure of the text by working the exercises on the chapters you read.

Grammar of the present participle. Careful attention is required to the following points:—

1. The verbal noun or gerund in *-ant* has the same form as the present participle, and is often called a participle, which is not strictly correct, since there is nothing adjectival about it. It is only employed after the preposition *en.*

2. Since a present participle is invariable, and an adjective agrees with the word it qualifies, it is important to distinguish between participles and adjectives which resemble them.

(*a*) The verbal form expressing an *action* is a participle, that denoting a *quality* is an adjective.

(*b*) The power of governing an object is a sure sign of the participle.

3. When one form ends in *-ent* and the other in *-ant*, the latter is the participle. Compare *excellent, excellant; resident, residant.*

4. Present participles of verbs whose stems end in a guttural keep *-gu* and *-qu* in their participles; compare *fabriquant* (part.), *fabricant* (adj. or noun), *fatiguant* (part.), *fatigant* (adj.).

This latter distinction is purely fanciful on the part of the grammarians; the distinction in (3) is based on etymology.

Second Year.—*Le Verre d'Eau*, Act V.

"WHO'S WHO AT CONFERENCE."

Our Conference Souvenir this year will take a perfectly unique form. Instead of providing the customary description of the *locale* of Conference, it will furnish a guide to its *personnel*—a matter of far greater interest and moment. We venture to think that this volume of N.U.T. biography will be valued by many teachers who may not visit Conference. We are therefore printing some extra copies for distribution to those of our readers who care to apply for them. A stamp should be enclosed for postage; and applicants should not expect to receive "Who's Who" until the Conference week is over.

QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

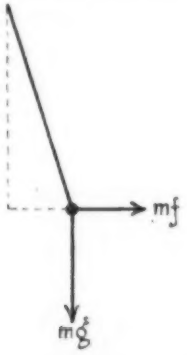
Progress.—(*a*) Show that a plumb-line suspended in a carriage of a train which is either increasing or diminishing its speed will not be vertical. Give a formula for deflection when steady.

Let m denote the mass at the end of the plumb-line.

T the tension of the string supporting the mass m.

And f the acceleration when the train is altering its speed.

As the body is stationary within the carriage, its acceleration is the same as that of the train; and, due to the inertia of



the body, when the train is started or stopped the string is deflected, and preserves for a short time an angle to the vertical.

Denoting this angle by α.

The horizontal and vertical components of T are equal to mf and mg respectively.

Therefore $mf = \mathrm{T} \sin \alpha$. . . . . (1).

And $mg = \mathrm{T} \cos \alpha$. . . . . (2).

Dividing (1) by (2), we obtain

$$\tan \alpha = \frac{f}{g}.$$

(*b*) A simple pendulum swings through an arc of 60°. Assuming that in every complete oscillation it loses $\frac{1}{10}$th of its initial energy, find how many complete oscillations it will make before the arc of swing becomes 30°.

Your solution is quite correct. The following is quicker and neater:—

Initial energy $= m(1 - \cos 30°)$

Energy when arc is $30° = m(1 - \cos 15°)$

Loss of energy $= m(1 - \cos 30°) - m(1 - \cos 15°)$

$$= m\left(\cos 15° - \frac{\sqrt{3}}{2}\right)$$

$$\text{Loss of energy per swing} = \frac{m}{10}\left(1 - \frac{\sqrt{3}}{2}\right)$$

$$\therefore \text{Number of swings} = \frac{\cos 15° - \frac{\sqrt{3}}{2}}{\frac{1}{10}\left(1 - \frac{\sqrt{3}}{2}\right)} \quad \ldots\ldots (1).$$

$$\cos 15° = \frac{1 + \sqrt{3}}{2\sqrt{2}}$$

Substituting this value in (1), we obtain

$$\frac{10(1 + \sqrt{3} - \sqrt{6})}{\sqrt{2}(2 - \sqrt{3})}.$$

This simplified is the answer required.

Pierre Corneille.—(*a*) Solve

$$x(x + 1)(x + 2)(x + 3) + 4(x + 5)(x - 2) = 0.$$

(*b*) Sum to n terms the series

$$1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + 3 \cdot 4 \cdot 5 + \ldots\ldots$$

(Oxford Local Senior, 1898.)

(*a*) Multiplying out, we obtain

$$x^4 + 6x^3 + 15x^2 + 18x - 40 = 0.$$

You are here expected to try if $x = \pm 1$, or ± 2, or ± 3, or ± 4, etc. It is no use trying 3, because if $x = 3$, then $x - 3$ is a factor; but this cannot be, for 3 will not divide into 40. You will find that x may be 1, and -4. Hence, $x - 1$ and $x + 4$ must be factors of the left-hand side; and by division you find that the other factor is $x^2 + 3x + 10$, and the equation is the same as

$$(x - 1)(x + 4)(x^2 + 3x + 10) = 0.$$

Therefore $x = 1$, or -4, and by putting $x^2 + 3x + 10 = 0$ you will not find any other real value of x. (See Hall and Knight's *Elementary Algebra*, Art. 230, Ex. 2; or Loney and Todhunter's *Algebra*, Art. 515. Also Art. 546 in Hall and Knight's *Higher Algebra* may interest you.)

(*b*) Working out a few of the terms, we get

$$6 + 24 + 60 + 120 + 210 + 336 + \ldots\ldots$$

Take differences between the terms and repeat this, thus obtaining this arrangement—

$$\begin{array}{ccccccc} 6 & + 24 & + 60 & + 120 & + 210 & + 336 & + \ldots\ldots \\ & 18 & 36 & 60 & 90 & 126 & \\ & & 18 & 24 & 30 & 36 & \\ & & & 6 & 6 & 6 & \\ & & & & 0 & 0 & \end{array}$$

When a series is such that the differences finally become zero, you may apply the very useful rules given in Art. 396 of Hall and Knight's *Higher Algebra*.

The answer is $\frac{1}{4}n(n + 1)(n + 2)(n + 3)$.

Integer.—In the December issue of THE PRACTICAL TEACHER, the answers given in the Theoretical Mechanics Notes to Exercise 4 are correct, namely:—

$$l = \frac{4\mu h}{\sin 2\theta(\sin\theta + \mu\cos\theta)} \quad . \quad . \quad . \quad (1).$$

And

$$\cos\theta \sin^2\theta + \mu \sin\theta \cos^2\theta = \frac{2h}{l}\mu \quad . \quad . \quad (2).$$

Putting in equation (1) $\mu = \tan\lambda$, the result agrees with that in the book to which you refer. If, in addition,

$$\frac{\frac{h}{l}}{2}$$

be put for $\sin\theta$ in equation (2), the answer for the limiting value of θ can also be obtained in the form $\frac{1}{2}\{\sin^{-1}(3\sin\lambda) - \lambda\}$. It is obvious that two values of θ can be found to satisfy. (2) Of these one is between 20° and 30°, the other between 70° and 80°; or we may solve equation (2) for μ.

$$\therefore \mu = \frac{\sin^2\theta\cos\theta}{\frac{2h}{l} - \cos^2\theta\sin\theta} \quad . \quad . \quad . \quad . \quad (3).$$

From (3) it follows that μ cannot increase indefinitely. This means that when μ is greater than a certain value, the rod will be in equilibrium for all values of θ from

$$\frac{\pi}{2} \text{ to } \sin^{-1}\frac{h}{l}.$$

We regret we cannot give you any information as to where you can get the wording of the deduction to which you refer.

A. Suggate.—

$$a\int_0^{\frac{\pi}{2}} (2\sin\theta - 1)\,d\theta = a\left[-2\cos\theta - \theta\right]_0^{\frac{\pi}{2}}$$

$$= a\left(-2\cos\frac{\pi}{2} - \frac{\pi}{2}\right) - a\left(-2\cos 0 - 0\right)$$

$$= -a\frac{\pi}{2} + 2a = \cdot 4292a.$$

Irwin.—Yes; if you have a good working knowledge of the work you mention, you ought to pass. To make certain, work through the *geometrical conics* as given in Wilson's *Solid Geometry*. With your knowledge of co-ordinate geometry, this ought not to be difficult.

NEW YORK LIFE INSURANCE COMPANY.

ANNUAL REPORT.

In presenting the Fifty-fourth Annual Statement of the Company's affairs, the management has the pleasing duty of congratulating the policy-holders on an exhibit of financial stability and a record of solid progress hardly paralleled in the history of the New York Life.

The Company's business has been steadily developed during the past year, with an increased measure of success. There were issued 73,471 policies, insuring £31,381,184, whereon the first premiums were received before the books closed on 31st December. The sum so insured exceeds the new business of 1897 by more than three million pounds, not including 835 old insurances revived and increased, amounting to £351,955. During the year 6,142 proposals for insurances, amounting to £3,289,472, were declined.

The number of policies in force has now reached 373,934, insuring £194,243,029. The net increase, after deduction of all matured and other terminated insurances, is £13,786,049. There are also 9,204 policies in force securing to the holders Annuities of £359,968.

The yearly income increased during 1898 by £748,730, and now amounts to £9,348,130, made up as follows: New premiums, less sum paid for re-assurances, £1,312,467; renewals, less re-assurance premiums, £5,747,271; interest receipts, £2,015,076. All these items show a considerable advance on the figures of the previous year. There was also received the sum of £272,081 for the purchase of Annuities, and £1,235 as deposits on account of Trust policies.

Claims by death amounting to £2,111,070, on the lives of over 2,850 policy-holders, were paid during the year. This sum is only £121,441 in excess of the amount so disbursed the previous year, notwithstanding the very large net increase in the amount at risk. The death claims are considerably below the "expectancy" indicated by the mortality tables in use by the Company, consequently a large saving has been effected under that head. Matured endowments show an increase of £147,517, and amounted to £748,261. Cash bonuses amounting to £567,784 were paid in 1898; this compares with £501,025 in 1897, £445,529 in 1896, and £372,085 in 1895. The management has again the satisfaction of announcing that, notwithstanding the strengthening of the reserves by the recent adoption of a more severe standard of valuation, the distribution of profits for the current year is on the same satisfactory scale as during the past four years. The sum paid during the year for purchased policies—a large proportion of which reached the end of the deferred dividend period, when the full reserve values may be withdrawn—was £690,365. Annuitants received £307,537, and Beneficiaries under Trust Fund policies £2,939. The total sum paid to policy-holders and their representatives amounted to £4,427,954, showing an increase over the sum so disbursed in the previous year of £434,239. The total expenditure incurred in the management of the Company and in the acquisition of the new insurances was £1,847,549, which, having regard to the larger volume of business secured, is relatively less than in 1897.

According to the law of the State of New York, all companies under the jurisdiction of the Government Insurance Department are compelled to maintain reserve funds which will, with the net premiums to be subsequently paid, if invested at 4 per cent. compound interest, enable the Company to discharge its obligations as they arise. The Net Policy Reserve on this basis, as per the accompanying certificate of the State Insurance Superintendent, is £36,154,372. To this sum has to be added various items classed as "general liabilities," amounting to £485,264, making the Total Liabilities, as per the Government standard, £36,639,636. The Surplus Reserve funds voluntarily set aside by the Company in excess of Governmental requirements now amount to £7,793,451, an unimpeachable record of financial strength. The total sum held as a liability to policy-holders is £44,433,089, which represents the entire Accumulated Funds of the Company, an increase over the previous year of £3,137,937.

During the past year the investments of the Company have shown an all-round increase in value, the appreciation of some securities being very marked. The market value at 31st December last of the bonds and stocks in excess of their cost increased from £1,194,924 at the beginning, to £1,524,965 at the end of the year. The popular loan feature of the Accumulation Policy of the New York Life is greatly appreciated, as evidenced by the fact that during the year no fewer than 7,400 policy-holders received loans aggregating over £820,000 on the sole security of their policies, without any charge beyond the interest and the stamps on the deeds. The sum now outstanding as loans on the Company's policies has reached the large total of £2,020,288. The yield from interest on the mean invested funds is now nearly 5 per cent., showing a further advance on the rate earned in respect of the Company's investments.

The New York Life during the past year has made great strides in the development of its extensive business ramifications throughout the world. The countries in which it has been established show, almost without exception, largely-increased totals compared with the preceding year, and the Company is everywhere viewed with increasing favour by the investing classes. In addition to the numerous Governmental authorities to whom the accounts have been annually submitted, there has now to be added that of Switzerland, where, in spite of very stringent requirements, the New York Life has been re-licensed to transact business.

In the United Kingdom the management has not only to chronicle the largest increase ever made in its returns in a single year, but to record the fact that the new insurances have been acquired at a diminished percentage of cost. It has thus been demonstrated that business conducted on healthy lines of development may be largely augmented without immoderate outlay.

The various districts throughout the country show, in nearly all cases, largely-increased returns. The newly-established Irish sub-department shows an exceedingly satisfactory record of completed business for its first year. Early in 1898 an office was opened at Inverness to serve as a centre for the North of Scotland district, under the charge of Mr. John M'Leod, M.P. Other new branches were opened in Carlisle, Preston, Hull, Grimsby, Crewe, Oxford, Bedford, Ipswich, Maidstone, Brighton, and Swansea. In the Metropolis new branches have been opened at New Cross and Fulham, and the principal City Branch has been transferred to more commodious premises at No. 2 Moorgate Street, E.C. Other extensions are in contemplation, and will be carried out as soon as the necessary arrangements are perfected.

Death has been busy in the Company's ranks during the year 1898. Several old and tried officials, who have spent a long period in the Company's service, have passed away. Mr. Archibald H. Welch, second Vice-President, died, after serving the Company in that and other capacities for many years, and was succeeded by Mr. George W. Perkins, he in turn being succeeded as third Vice-President by Hon. Darwin P. Kingsley, formerly Agency Superintendent at the Head Office, and previously Insurance Commissioner for the State of Colorado. Mr. Edmund D. Randolph, an American Director of the Liverpool and London and Globe Insurance Company, was appointed Chairman of the Executive Committee of the New York Life during the year; thus another connecting link is formed between the business enterprises carried on here and in the United States. The management sincerely deplores the loss of its oldest Trustee in this country, Mr. Frederick Chalmers, so long and favourably known in connection with the business of Messrs. Brown, Shipley, and Co.

Much to the regret of his colleagues, Colonel Alexander G. Hawes, who acted as General Manager of the British Department from August 1895, retired in October last on account of indifferent health, and was succeeded by Mr. C. Seton Lindsay, who had for some months previously been in charge of the Department. Early in the year Mr. T. J. Pulling, who has seen many years' service with the Company, was appointed Agency Director. In August last Sir William MacCormac, Bart., K.C.V.O., President of the College of Surgeons, was appointed Chief Medical Officer of the British Department. To facilitate the more rapid dispatch of its business a Resident Board has been established, which is empowered to accept proposals for insurance without reference (excepting in special cases) to the Head Office of the Company.

The British Department is indebted to Mr. G. W. Perkins, second Vice-President, for many advantageous changes which have been inaugurated as a direct result of his visit to England last summer. During his stay Mr. Perkins travelled over the country, visiting a number of important centres where inspiring and helpful addresses were delivered to the local staffs. In this way the needs of each locality have been brought under the personal attention of the Executive, with great advantage to the business.

The Company has recently brought out a new form of policy, called the Accumulation Policy with Maximum Guarantees. This form of policy meets the wants of insurants, particularly at the younger ages, in that it gives them a large proportionate return on the investment of moderate sums. The new policy has met with a very cordial reception, and full information will be forwarded to any one desiring particulars.

Probably at no period of its history has the New York Life received so many acknowledgments of satisfaction with the results of policies and prompt settlement of claims as during the past year. Some of the letters afford striking instances of the value of life insurance, and of an investment in the Company for the living policy-holder. A pamphlet, entitled "British Testimony," giving particulars of these, may be obtained on application to the Chief Office, or at any of the Company's branches.—(ADVT.)

J. M'Intosh (Straits Settlements).—(*a*) An alphabet consists of m (consonants) and n (vowels), m being greater than n. Find the number of ways in which all the letters of the alphabet may be arranged so that each of the vowels shall be between two consonants.

(*b*) If $\frac{(1+2x)^m}{1-x}$ be expanded in ascending powers of x, prove that the coefficient of any power of x greater than $m-1$ is 3^m, m being a positive integer. (Cambridge Senior, 1898.)

(*a*) There will be $m-1$ places for the vowels. Taking one vowel, where may we place it? Clearly, in any *one* of $m-1$ places: put it in one of them. Take a second vowel; it can be placed in any one of $m-2$ places: place it in one. It will be seen that there are $(m-1)(m-2)$ ways of placing two vowels, and, similarly, there are $(m-1)(m-2)\ldots.(m-1-n+1)$ ways of placing the n vowels. Now each time we arrange the n vowels there are $\lfloor m$ ways of arranging the m consonants. Hence there are $\lfloor m\,(m-1)(m-2)\ldots.(m-n)$ ways of arranging the alphabet.

(*b*)
$$\frac{(1+2x)^m}{1-x} = (1+2x)^m(1-x)^{-1}$$
$$= \Big(1 + m\,.\,2x + \frac{m(m-1)}{1\,.\,2}2^2x^2 + \ldots. + m2^{m-1}x^{m-1} + 2^m x^m\Big)$$
$$(1 + x + x^2 + \ldots. + x^m + x^{m+1} + \ldots. \text{ to inf.}).$$

Thus we have on the right the product of a finite series (because m is a *positive* integer) and an infinite series.

Now consider the term x^m arising out of the product of these two series. In forming this one term only, *every* term in the first factor will combine with the proper term in the second factor; and since in this second factor the coefficient of every term is unity, you will see that the coefficient of x^m will be the sum of all the coefficients in the first factor. But these coefficients of $(1+2x)^m$ have for their sum what $(1+2x)^m$ becomes when we put 1 for x; this will be $(1+2)^m$, or 3^m. The same reasoning holds if we try to form the coefficient of powers of x above the mth.

(*Replies to other queries are being sent per mail.*)

Industry.—We are not aware of any single book which deals specially with the type of question to which you refer. To some extent you will find Wilson's *Solid Geometry*, and Millar's *Descriptive Geometry*, both published by Macmillan, useful.

The third question to which you refer is surely wrongly stated: "If two circles in different planes intersect in two points, they both lie on the same plane."

Math. and *J. A. L.*—P is any point inside a triangle ABC; its distances from A, B, C are l, m, n respectively. Show that $l^2(m^2+n^2-a^2)^2 + m^2(l^2+n^2-b^2)^2 + n^2(l^2+m^2-c^2)^2 = (m^2+n^2-a^2)(l^2+n^2-b^2)(l^2+m^2-c^2) + 4l^2m^2n^2$. (Third Stage, 1897.)

The expressions like $m^2+n^2-a^2$ suggest the use of the relation $a^2+b^2-c^2 = 2ab\cos C$.

Let α, β, γ be the angles at P subtended by a, b, c.

Then
$$m^2+n^2-a^2 = 2mn\cos\alpha,$$
$$l^2+n^2-b^2 = 2ln\cos\beta,$$
$$l^2+m^2-c^2 = 2lm\cos\gamma.$$

Using these, the left-hand side becomes

$$4l^2m^2n^2(\cos^2\alpha+\cos^2\beta+\cos^2\gamma),$$

or
$$2l^2m^2n^2(1+\cos 2\alpha+1+\cos 2\beta+1+\cos 2\gamma)$$
$$= 2l^2m^2n^2[3+2\cos(\alpha+\beta)\,.\,\cos(\alpha-\beta)+\cos 2\gamma]$$
$$= 2l^2m^2n^2[3+2\cos\gamma\,.\,\cos(\alpha-\beta)+2\cos^2\gamma-1]$$
(because $\alpha+\beta+\gamma=2\pi$)
$$= 2l^2m^2n^2[2+2\cos\gamma\{\cos(\alpha-\beta)+\cos\gamma\}]$$
$$= 4l^2m^2n^2[1+\cos\gamma\{\cos(\alpha-\beta)+\cos(\alpha+\beta)\}]$$
$$= 4l^2m^2n^2 + 4l^2m^2n^2\cos\alpha\,.\,\cos\beta\,.\,\cos\gamma.$$

The right-hand side is at once seen to reduce to this, by substituting $2mn\cos\alpha$ for $m^2+n^2-a^2$, etc., as above.

Dubious.—Given that a metre is 3·3708 inches longer than a yard, express the difference between 10 square metres and 12 square yards as the decimal of a square metre correct to three places.

Yes. The answer given is correct.

A square yard $= 36^2 = 1296$ square inches.

A square metre $= 39{\cdot}3708^2 = 1550{\cdot}05989264$ square inches.

Hence the answer is $\frac{(12\times 1296) - 15500{\cdot}5989264}{1550{\cdot}05989264} = \underline{{\cdot}003}$.

K. W.S.—The tangents of two of the angles of a triangle are 2 and 3 respectively. Find the ratio of the radius of the circumscribing circle to the radius of the inscribed circle.

Let R and r be the radii of the two circles respectively.

Then $\mathrm{R} = \frac{a}{2\sin\mathrm{A}}$, and $r = a\,\frac{\sin\frac{\mathrm{B}}{2}\sin\frac{\mathrm{C}}{2}}{\cos\frac{\mathrm{A}}{2}}$. (Loney, p. 232.)

$$\therefore \frac{\mathrm{R}}{r} = \frac{a}{2\sin\mathrm{A}}\times\frac{\cos\frac{\mathrm{A}}{2}}{a\sin\frac{\mathrm{B}}{2}\sin\frac{\mathrm{C}}{2}} = \frac{\cos\frac{\mathrm{A}}{2}}{4\sin\frac{\mathrm{A}}{2}\cos\frac{\mathrm{A}}{2}\sin\frac{\mathrm{B}}{2}\sin\frac{\mathrm{C}}{2}}$$
$$= \frac{1}{4\sin\frac{\mathrm{A}}{2}\sin\frac{\mathrm{B}}{2}\sin\frac{\mathrm{C}}{2}}.$$

Now
$$\tan\mathrm{A} = -\tan(\mathrm{B}+\mathrm{C}) = -\frac{\tan\mathrm{B}+\tan\mathrm{C}}{1-\tan\mathrm{B}\,.\,\tan\mathrm{C}} = -\frac{2+3}{1-6} = 1.$$

Since $\tan\mathrm{A}=1$, $\tan\mathrm{B}=2$, $\tan\mathrm{C}=3$,

then $\cos\mathrm{A} = \frac{1}{\sqrt{2}}$, $\cos\mathrm{B} = \frac{1}{\sqrt{5}}$, $\cos\mathrm{C} = \frac{1}{\sqrt{10}}$.

Now
$$\sin\frac{\mathrm{A}}{2} = \sqrt{\frac{1-\cos\mathrm{A}}{2}} = \sqrt{\frac{1-\frac{1}{\sqrt{2}}}{2}} = \sqrt{\frac{\sqrt{2}-1}{2\sqrt{2}}};$$

similarly, $\sin\frac{\mathrm{B}}{2} = \sqrt{\frac{\sqrt{5}-1}{2\sqrt{5}}}$; $\sin\frac{\mathrm{C}}{2} = \sqrt{\frac{\sqrt{10}-1}{2\sqrt{10}}}$.

Hence
$$\frac{\mathrm{R}}{r} = \frac{1}{4}\sqrt{\frac{2\sqrt{2}\,.\,2\sqrt{5}\,.\,2\sqrt{10}}{(\sqrt{2}-1)(\sqrt{5}-1)(\sqrt{10}-1)}}$$
$$= \frac{5}{6}\sqrt{(\sqrt{2}+1)(\sqrt{5}+1)(\sqrt{10}-1)}.$$

Oxonian.—A and B run a mile, and A wins by 80 yards. A and C run over the same course, and A wins by 20 seconds. B and C run, and B wins by 5 seconds. In what time can A run a mile? (Pendlebury's *Arithmetic*, p. 268, No. 11.)

The second statement tells us that C requires 20 seconds more time than A; the third tells us that B takes 5 seconds less time than C; hence B must take 15 seconds more than A. Combining this with the first statement, B runs 80 yards in 15 seconds. Therefore, when A is at the winning post—namely, when B has run 1760 − 80 = 1680 yards—the time which has elapsed since the start must be

$$\frac{1680}{80}\times 15 = 315 \text{ seconds} = \underline{5\tfrac{1}{4} \text{ minutes}}.$$

S. W. Sharpe.—Instead of a payment of £8,815, 12s. 7d. at the end of three years from the present time, it has been agreed that five equal sums shall be paid, one such sum at the end of each of five successive years from the present time. What should the annual payment be, if money is worth 4 per cent. per annum, and compound interest is reckoned?

(College of Preceptors, Midsummer, 1898.)

Let the "annual payment" be called £x. If £x paid at the end of the first year from present time were put out at 4 per cent. compound interest, it would at the end of three years amount to $x\times\frac{104}{100}\times\frac{104}{100} = £x\times(1{\cdot}04)^2$. That is, £$x\times(1{\cdot}04)^2$ is the equivalent value, at third year end, of the first payment.

Similarly, £$x\times 1{\cdot}04$ is the equivalent value, at third year end, of the second payment.

The third payment of £x *is actually paid* at third year end.

The equivalent value, at third year end, of the fourth payment is £$x\times\frac{100}{104}$; because this sum, if put out at 4 per cent. compound interest for one year, would amount to £x.

Similarly, the equivalent value of the last payment is £$x\times\left(\frac{100}{104}\right)^2$. The sum of these five equivalent values must be equal to £8,815, 12s. 7d., the sum actually due at the third year end.

Hence £$x\left(1{\cdot}04^2+1{\cdot}04+1+\frac{1}{1{\cdot}04}+\frac{1}{1{\cdot}04^2}\right) =$ £8,815, 12s. 7d.

$$\therefore x = £\frac{8{,}815,\ 12\text{s. }7\text{d.}}{5{\cdot}0077}. \quad \text{Ans.}$$

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CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),

First Class Honoursman in Chemistry (Science and Art Department); Head-Master, Finchley School of Science, and Lecturer therein on Chemistry.

Sodium Peroxide as a Reagent.—The use of Na_2O_2 to separate the members of Group III. (A)—namely, Fe, Cr, Al—is not nearly so general as it deserves to be, hence it is worth while to call special attention to the reagent and its mode of action. The separation depends upon (1) the oxidation of chromic oxide to chromic acid, and (2) the solubility of $Al_2(OH)_6$ in caustic alkalis. The precipitate obtained by the addition of NH_4Cl and NH_4OH to the filtrate from Group II. is washed and transferred to a test-tube with a little water, to which is added a small portion of Na_2O_2, which converts the chromium compound into Na_2CrO_4 and the $Al_2(OH)_6$ into sodium aluminate Al_2O_3, $3Na_2O$, both of which are in solution in the filtrate, which contains NaHO, formed by the action of Na_2O_2 on H_2O, the precipitate being the $Fe_2(OH)_6$. The filtrate is divided into two portions, one of which is acidified with acetic acid and tested with $Pb(NO_3)_2$ + Cr, the other being acidified with dilute HNO_3 and afterwards treated with NH_4OH, which precipitates the Al as gelatinous $Al_2(OH)_6$.

Displacement of Metals by Magnesium.—Mr. E. G. Bryant, B.Sc., who has given much attention to this question ever since the displacement of Cu by Mg was set as an elementary exercise by the Science and Art Department, again returns to the attack in the *Chemical News* for February 17. He shows that when Mg is allowed to displace Zn in a solution of $ZnSO_4$, that never much more than 50 per cent. of the theoretical amount of Zn is deposited; that in the case of Mg acting on a solution of $Pb(NO_3)_2$ or $Pb(C_2H_3O_2)_2$, only 50 per cent. of the theoretical quantity of Pb is deposited; and, although from 60 to 100 per cent. of the theoretical quantity of Ag is deposited by the action of Mg in a solution of $AgNO_3$, Mr. Bryant points out that the precautions necessary to get even this degree of accuracy are such as stamp the exercise as anything but an elementary one. Our readers will remember that the action of Mg on $CuSO_4$ gives the same poor results, but that Clewes and Coleman found that when iron displaces copper from the sulphate solution a reliable result is readily obtainable. The question is a very important one for teachers of elementary practical chemistry, who will do well to set no exercise on finding the equivalent of an element by the displacement method without themselves first carefully estimating the quantity deposited, and the conditions under which the deposition occurs.

Calcium Arsenide.—This body has been prepared in the electric furnace by M. Lebeau, who found that the crystals had the composition represented by the formula As_2Ca_3, corresponding to the nitride N_2Ca_3. As in the case of the nitride and phosphide of calcium, this arsenide decomposes water at ordinary temperatures, giving gaseous AsH_3 and $Ca(OH)_2$. The arsenide prepared by the direct union of calcium and arsenic has exactly the same composition.

Chlorates by the Electrolysis of Chlorides.—The importance of alkaline chlorates in the manufacture of matches and in pyrotechny has led to several improvements upon the old method of first preparing $Ca(ClO_3)_2$ by passing Cl into milk of lime and then treating the calcium compound with the proper amount of KCl to produce $KClO_3$ by double decomposition. Of these improvements the most important is the production of $KClO_3$ by the electrolysis of a solution of KCl. Concerning this method, it is to be remarked that the return in chlorate is augmented when the liquid in the anodic compartment is kept alkaline by the addition of from 1 to 5 per cent. of K_2CO_3 or Na_2CO_3, whereby is prevented the formation of caustic alkali at the carbon electrodes, and a greater return in Cl is obtained.

Herr Vanbel's Improved Method.—In the *Chemiker Zeitung*, Herr Vanbel outlines an improvement in this electrolytic method which is likely to facilitate the manufacture not only of chlorates, but of bromates, iodates, and hypochlorites. He finds that by employing a diaphragm, and by using $NaHCO_3$ in the anodic compartment and the alkaline chloride as the kathodic solution, all the chlorine carried to the anode is quickly transformed into chlorate, according to the following equation, in which the elements marked + collect at the anode, and those marked − collect at the kathode.

$$\overset{-}{Na}\overset{+}{Cl} + \overset{-}{Na}H\overset{+}{C}O_3 = 6NaClO_3 + 6CO_2 + 6\overset{-}{Na} + 3H_2O.$$

In the reaction six atoms of Na are disengaged for each molecula of chlorate formed

$$3Cl_2 + 6NaHO = 3NaCl + NaClO_3 + H_2O.$$

The CO_2 evolved can be collected in solutions of Na_2CO_3, to be again used as $NaHCO_3$. The temperature of the reaction is from 60° to 70° C., and the density of the current may vary from 5 to 10 ampères per square decimetre. The electrolysis gave a solution of 6·5 grams $NaClO_3$ for every 7·5 grams $NaHCO_3$. At the commencement of the electrolysis the kathode compartment contained a saturated solution of NaCl. At the conclusion its contents were a 10 per cent. solution of NaHO, containing but a small proportion of NaCl. The working conditions are the same for $KClO_3$ as for the sodium compound.

Bromates, Iodates, Hypochlorites.—These can be produced in a satisfactory condition of purity, *mutatis mutandis*, by the method just described—the only point to be especially noted being that a low temperature must be maintained when it is desired to produce the hypochlorite. The student will, of course, see the connection between this method and the usual methods of passing Cl into a heated solution of KHO, when KCl and $KClO_3$ result, the chloride and hypochlorite being the products when the KHO is kept ice-cold. Attempts to produce the corresponding fluorates by this method failed altogether, as might have been expected.

Perchlorates.—According to Herr Winteter, the prolonged electrolysis of the alkaline chlorides, or chlorides of the alkaline earths, in aqueous solution with platinum electrodes may give rise to the formation not only of chlorates and hypochlorites, but also to that of perchlorates. When the electrolysis of the solutions of alkaline chlorides between the platinum electrodes has arrived at such a point that all the chloride is transformed into chlorate, the best conditions for the further oxidation of the chlorate into perchlorate are as follows:—

1. The solution must be acid at the anode.
2. The temperature must be low at the anode.
3. The density of the current should be from 4 to 12 ampères per square decimetre.
4. The electrolyte should be a saturated solution.

Separation of Chloride, Bromide, and Iodide of Silver.—M. Baubigny, who has paid much attention to this important separation, treats the precipitate, whilst still wet, with nitric acid and crystals of potassium permanganate. This mixture transforms the iodide into iodate, and does not sensibly act on the chloride. The bromide is attacked very slowly. As fluorescin paper is exceedingly sensitive to bromide vapour, mere traces of this element can be detected with certainty.

Heat of Formation of Lime.—M. Henri Moissan, taking advantage of the purity of the lime produced in his electrical furnace, has redetermined the heat of formation of slaked lime. This he finds to be 145 calories, which is higher than that of the

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oxides of sodium, potassium, and lithium; a fact that has been confirmed by the separation of lithium upon heating lithium and calcium together in a vacuum.

Molecular Weights from the lowering of the freezing-point of solvents.—Our knowledge of the molecular weights of inorganic substances is in great part derived from the classical researches of Victor Meyer and his pupils in vapour densities at very high temperatures. A few determinations of the molecular weights of inorganic salts have been made by the boiling-point method, the most interesting conclusion obtained in this way being that cuprous chloride and bromide are represented by the simple formulæ CuCl, CuBr. In the current number of the *Gazetta Chimica Italiana*, the problem is attacked by N. Castoro by the cryoscopic method. A satisfactory solvent was found in urethane, in which a considerable number of inorganic substances can be dissolved. The lowering of the melting-point was determined for silver nitrate, and the chlorides of mercury, cobalt, copper, cadmium, zinc, tin, and manganese. Of these, cupric and cobalt chlorides had the double formulæ Cu_2Cl_4 and Co_2Cl_4 quite clearly marked; manganese chloride showed some tendency to the formation of double molecules; whilst the remaining salts gave figures closely agreeing with those calculated on the assumption of the simple formulæ.

Acetylene.—An exhibition has been held at the Imperial Institute of generators of C_2H_2 by the action of carbide of calcium (CaC_2) on water, and it has been declared by a Committee of the Society of Arts that many of the types of generators—which included (1) those in which the gas is generated by water being allowed to drip on the carbide, (2) those in which the water is allowed to rise into contact with the carbide, and (3) those in which the carbide drips into the water—are perfectly safe, and that there should be no more danger in lighting by acetylene than in the employment of any other artificial light. The Committee add, however, that the generation of the gas within the house, and its use in hand lamps, cycle lamps, etc., is not unattended by danger, except in skilled hands.

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BY G. A. BAXANDALL,
Mathematical and Mechanical Division, Royal College of Science, London; Lecturer on Theoretical Mechanics, City of London College.

Stage 2.

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Ratio, Proportion, and Variation.—Learn the exact meanings of the terms *ratio*, *antecedent*, *consequent*, *compound ratio*, *duplicate* and *sub-duplicate ratio*. Also learn what is to be understood when we say that *four quantities are proportionals*, or when a number of quantities are said to be in *continued proportion*; also when a quantity is a *mean proportional* between two others; and lastly, what is meant when one quantity is said to vary *directly* or vary *inversely* as another.

The definitions of the above terms will be found in Hall and Knight's *Elementary Algebra*, chap. xxii.; Hamblin Smith's *Elementary Algebra*, chaps. xxvii., xxviii., xxix.; C. Smith's *Elementary Algebra*, chap. xxi.

We shall briefly refer to a few of the more important points, including certain useful *tricks* or *artifices*.

1. If you have a fraction like $\frac{4x+5y}{3x-2y}$, you are expected to always be ready to divide each term by x or y, and thus obtain

$$\frac{4+5\frac{y}{x}}{3-2\frac{y}{x}}, \text{ or } \frac{4\frac{x}{y}+5}{3\frac{x}{y}-2}.$$

So that if you know the value of $x \div y$ to be, say, 6, then the value of

$$\frac{4x+5y}{3x-2y} \text{ is } \frac{4\times 6+5}{3\times 6-2}, \text{ or } \frac{29}{16}.$$

2. If you know that three quantities are *in the ratio* of 14 : 8 : 3, become accustomed to instantly expressing the actual quantities as $14x$, $8x$, and $3x$ respectively; the value of x may be found from further information.

3. Let a, b, c, d be four *proportionals*, then $\frac{a}{b}=\frac{c}{d}$. If, however, a, b, c, d be in continued proportion, it is still *true* that $\frac{a}{b}=\frac{c}{d}$; but in addition, each of these fractions is equal to $\frac{b}{c}$.

Now, in problems on proportion, if we have several fractions equal to each other, the method which should be invariably tried is to denote each fraction by another letter, say k, and then cross-multiply. Thus, if a, b, c, d are proportionals, put

$$\frac{a}{b}=\frac{c}{d}=k,$$

then $$a=bk,\ c=dk.$$

Or if a, b, c, d are in continued proportion, we write

$$\frac{a}{b}=\frac{b}{c}=\frac{c}{d}=k,$$

then $$a=bk,\ b=ck,\ c=dk,$$

$$\therefore a=ck^2=dk^3, \text{ or } b=dk^2.$$

These short equations are then used for purposes of substitution.

4. Every one understands what is meant when it is said that at a cricket match for which there is only one price of admission the money, M, taken at the gates is directly *proportional* to the number of spectators, N. We express this fact shortly by writing $M \propto N$. But, also, it is clear that the money taken is *equal* to the number of spectators multiplied by the price of admission—that is,

$$M = cN,$$

where c stands for the price of admission. Hence, whenever we have such a statement as

$$M \propto N,$$

we instantly write

$$M = cN,$$

where the value of the constant, c, is always given in some way or other.

As a *typical example* take the following:—The time, t, required to dig a trench is *directly* proportional to each of its dimensions—length l, breadth b, and depth d—but *inversely* proportional to the number of men, m; hence we may write

$$t \propto \frac{lbd}{m},$$

and therefore $$t = c.\frac{lbd}{m}.$$

Now, in an example, t, l, b, d, m would be given, and this would enable us to find c. Then knowing c, we could find any *one* of the *five* quantities, t_1, l_1, b_1, d_1, m_1, if the remaining *four* were given.

Work the following:—

Hall and Knight's *Elementary Algebra*, Ex. xxxii. (*a*), Nos. 8, 10, 15, 18; Ex. xxxii. (*b*), Nos. 10, 12, 16, 19; Ex. xxxii. (*c*), 1, 5, 13, 22, 24.

Hamblin Smith's *Elementary Algebra*, Ex. cxxix., Nos. 5, 9; Ex. cxxxi., Nos. 1, 3, 6, 13; Ex. cxxxii., Nos. 4, 10, 14; Ex. cxxxiii., Nos. 4, 10, 14, 19.

C. Smith's *Elementary Algebra*, Ex. lx., Nos. 2, 7, 10, 16; Ex. lxi., Nos. 4, 7, 16, 20; Ex. lxii., Nos. 1, 7, 9, 13.

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Solution of Triangles.—To a student who has, by continual and steady practice, become proficient in the use of mathematical tables, the solution of any triangle is a very simple matter indeed. It is true that a problem on heights and distances may be rather troublesome, but when certain sides and angles of a triangle are definitely given, the calculation of the remainder should give little trouble.

Let the student copy down on a piece of paper convenient for use the half-dozen or so formulæ required for the solution of triangles; these he will find in the text-books. They are as follows:—

1. $$\sin\frac{A}{2}=\sqrt{\frac{(s-b)(s-c)}{bc}};\quad \cos\frac{A}{2}=\sqrt{\frac{s(s-a)}{bc}};$$
$$\tan\frac{A}{2}=\sqrt{\frac{(s-b)(s-c)}{s.(s-a)}}.$$

2. $$\frac{\sin A}{\sin B}=\frac{a}{b}, \text{ or } \frac{\sin A}{\sin C}=\frac{a}{c}, \text{ or } \frac{\sin B}{\sin C}=\frac{b}{c}.$$

3. $$\tan\frac{B-C}{2}=\frac{b-c}{b+c}\cot\frac{A}{2}.$$

These formulæ contain the three angles A, B, C, and the opposite sides a, b, c of a triangle, s denoting $(a+b+c)\div 2$. When any three of these six quantities are given, the remaining three can be calculated, excepting the case where A, B, C are given. Using these formulæ, work out the following examples, using your own book of tables:—

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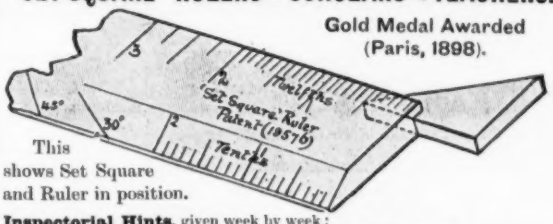

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1. Take A = 35°, B = 76°, a = 23·46, find b.

Ans. 38·43.

2. Take B = 42° 15′, b = 9·68, c = 4·23, find C, and hence A.

Ans. C = 17°·6′; A = 120°·39′.

3. Take a = 6·9, b = 4·7, c = 8·6,

find $\sin\frac{A}{2}$, $\cos\frac{B}{2}$, $\tan\frac{C}{2}$,

and thus determine A, B, C to the nearest minute.

Ans. ·4476; ·2588; 1·068; 53°·12′; 33°; 93°·48′.

4. Take A = 48°·16′, b = 9·84, c = 7·26,

find $\tan\frac{B-C}{2}$, and hence $\frac{B-C}{2}$.

Remembering that $\frac{A}{2}+\frac{B}{2}+\frac{C}{2}=90°$,

and that therefore

$$\frac{B+C}{2}=90-\frac{A}{2}=90-24°·8′=65°·52′,$$

you may now calculate B and C.

[Observe that cot 24°·8′ = tan (90 − 24°·8′) = tan 65°·52′.]

Ans. $\tan\frac{B-C}{2}$ = ·3367; $\frac{B-C}{2}$ = 18°·36′;

B = 84°·28′; C = 47°·16′.

5. The area of a triangle being half the product of two sides and the sine of the included angle, determine the area of the triangle in Ex. 4. Ans. 26·65.

The above examples may be regarded merely as practice in the use of mathematical tables. By working a sufficient number of examples from the text-book in the same way, one may gradually learn the formulæ, and be able to determine in any particular example which formula should be used.

Stage 3.

Algebra.

Binomial Theorem.—Hall and Knight's *Higher Algebra*, Arts. 163, 167, 170, 172, 173, 174, 186, 190, 191.

Todhunter and Loney's *Algebra*, Arts. 446, 448, 454, 457, 458, 460, 463.

Todhunter's *Algebra*, Arts. 504, 506, 507, 513, 514, 521, 523, 524.

It may be useful to refer to what the student should principally notice.

1. The more useful form of the binomial theorem is—

$$(1+x)^n=1+nx+\frac{n(n-1)}{1\cdot 2}x^2+\frac{n(n-1)(n-2)}{1\cdot 2\cdot 3}x^3+\ldots.$$

2. The $(r+1)^{th}$ term of this is—

$$\frac{n(n-1)(n-2)\ldots(n-r+1)}{\lfloor r}x^r$$

whatever n may be. This is the most important thing to remember. Observe that there are r factors in the numerator.

3. Any binomial, however complicated, say $z^2-\frac{4x}{y}$, may be written so as to include a factor of the form $(1+x)$. Thus—

$$\left(z^2-4\frac{x}{y}\right)=z^2\left[1+\left(-\frac{4x}{z^2y}\right)\right],$$

in which $-\frac{4x}{z^2y}$ takes the place of x in $(1+x)$.

4. Knowing the expression for the $(r+1)^{th}$ term, the task of writing down any term in a given binomial expansion consists simply of substituting in for x, r, and n. It is the process of simplifying which gives trouble. The worked-out examples in your text-books should help you a little here.

As an example, let us find the 15th term of $\left(z^2-\frac{4x}{y}\right)^{-3}$. From the above it will be seen that

$$\left(z^2-\frac{4x}{y}\right)^{-3}=\left[z^2\left\{1+\left(-\frac{4x}{z^2y}\right)\right\}\right]^{-3}$$
$$=z^{-6}\left\{1+\left(-\frac{4x}{z^2y}\right)\right\}^{-3}$$

Put into the expression for the $(r+1)^{th}$ term, r = 14, n = −3, and $-\frac{4x}{z^2y}$ for x, then our 15th term is—

$$z^{-6}\left[\frac{(-3)(-4)\ldots(-3-14+1)}{\lfloor 14}\right]\left(-\frac{4x}{z^2y}\right)^{14}$$
$$=z^{-6}\left(\frac{1\cdot 2\cdot 3\cdot 4\ldots 16}{\lfloor 2\quad \lfloor 14}\right)(-1)^{14}(-4)^{14}\frac{x^{14}}{z^{28}y^{14}}(-1)^{14}$$
$$=\frac{16\times 15}{2}4^{14}x^{14}y^{-14}z^{-36}=120\times 4^{14}.x^{14}.y^{-14}z^{-36}.$$

5. It is useful to remember or to observe the series arising by giving to n such simple values as −1, −2, in $(1+x)^n$.

Work the following:—

Hall and Knight.—Ex. xiii. (*a*), Nos. 1, 10, 18, 26, 35; Ex. xiii. (*b*), Nos. 5, 7, 16; Ex. xiv. (*a*), Nos. 2, 4, 17, 21; Ex. xiv. (*b*), Nos. 1, 2, 11; Ex. xiv. (*c*), Nos. 2, 4, 13.

Todhunter and Loney.—Ex. cvi., Nos. 1, 6, 11, 14, 24, 29; Ex. cvii. 1, 5, 8, 10, 18, 23.

Todhunter.—Ex. xxxv., p. 306, Nos. 1, 3, 6, 9, 15, 18; Ex. xxxvi., Nos. 1, 6, 13, 20, 28, 34, 36.

Trigonometry.

Some Miscellaneous Items.—Loney's *Trigonometry.* Arts. 81 to 86, 102 to 104. *Read* carefully through the examples worked out in Arts. 109 to 119. Arts. 120 to 123. Examples 1, 2, 3, in Art. 127, should be read. Arts. 128 to 133. Read through the worked-out examples of Art. 173.

Todhunter's *Trigonometry.*—Arts. 66 to 69; 100; 107 to 111; 114, 115, 129, 308.

Hall and Knight's *Trigonometry.*—Arts. 134, 135, 149. *Work* Ex. 26, p. 163. Arts. 236 to 243; 251 to 260; 317 to 319.

Lock's *Trigonometry.*—Arts. 143 to 149; 176, 177; 184, 185; 235.

Geometry.

The most important propositions in Book VI. are 2 to 8, 11, 12, 13, 19, 31. All definitions of terms used in Book VI. should be carefully studied.

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Light.—A compound achromatic lens of focal length 40 cms. is to be constructed of two thin crown-glass and flint-glass lenses in contact, the surfaces that are in contact having a common radius of 25 cms., the optical character of the glasses employed being as follows, namely:—

	Dispersive Power.	Refractive Index for Middle of Spectrum.
Crown glass	0·21	1·5
Flint glass	0·45	1·6

Calculate the radius of the second face of each lens, and establish the formulæ employed in the calculation.

(B.Sc. (London) Honours, 1884.)

It is first of all necessary to establish a formula showing the connection between the positions of the object and the image when light is refracted through a curved surface into a dense medium.

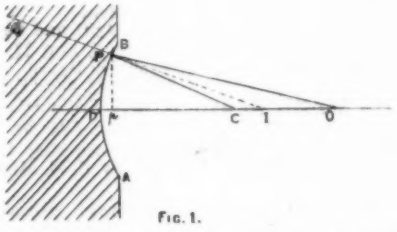

Fig. 1.

1. Refraction at a Curved Surface.—Let AB be part of the spherical boundary of a dense medium. If the shaded portion of the diagram denotes the dense medium, then the surface as represented is concave. Let C be the centre of curvature of this surface, O the position of the object, OP a particular ray of light incident at P, and refracted into the dense medium along PQ. Produce the straight line QP to I, its point of intersection with the line joining O and C. Then, since the ray of light passing along OCD will be incident normally on the surface of the medium, it will be transmitted without refraction. Consequently both the rays OCD and PQ will appear to diverge from I. This point is therefore the image (in this case virtual) of the object O. Then

Angle of incidence = CPO,

Angle of refraction = CPI.

$\therefore$ sin CPO = μ sin CPI,

where μ is the refractive index of the medium.

Drop a perpendicular, Pp, on to OC produced. Let $Pp = d$. Then the ordinary formulæ for lenses with spheri-

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cal surfaces will hold only when Pp is small in comparison with DC, DI, and DO. In this case CPO and CPI are both small angles. Hence we may take the circular measure of these angles as equal to their sines or tangents. Now

$$\angle \text{PCD} = \angle \text{POD} + \angle \text{CPO},$$

$$\therefore \text{Angle of incidence} = \angle \text{CPO} = \angle \text{PCD} - \angle \text{POD}.$$

The circular measure of $\angle$ PCD may be taken as equal to $\frac{Pp}{PC} = \frac{d}{R}$, if R is the radius of curvature of the surface. Similarly we may take OB = OD to a first approximation, and therefore circular measure of $\angle \text{POD} = \frac{Pp}{PO} = \frac{Pp}{DO} = \frac{d}{u}$, if u is the distance DO from the surface to the object.

Hence

$$\text{Angle of incidence} = \angle \text{CPO} = \frac{d}{R} - \frac{d}{u} = d\left(\frac{1}{R} - \frac{1}{u}\right).$$

Similarly, if the distance DI from the surface to the image is taken as v, we have

$$\text{Angle of refraction} = \angle \text{CPI} = d\left(\frac{1}{R} - \frac{1}{v}\right).$$

$$\therefore d\left(\frac{1}{R} - \frac{1}{u}\right) = \mu\, d\left(\frac{1}{R} - \frac{1}{v}\right).$$

$$\therefore \frac{\mu}{v} - \frac{1}{u} = \frac{\mu - 1}{R} \quad . \quad . \quad . \quad . \quad . \quad (1).$$

Before proceeding further, we must see whether this formula will need modification when a convex surface is in question.

Let AB (Fig. 2) represent a convex spherical surface bounding a dense medium; the space occupied by the latter

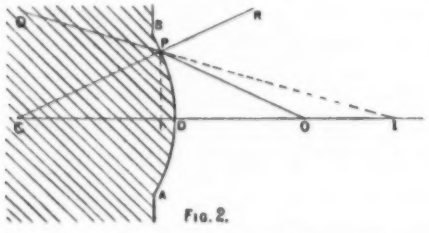

FIG. 2.

is shaded. Let C indicate the position of the centre of curvature, O that of the object, and I that of the image (virtual).

Consider a ray, OP, incident at a point P. Produce the radius of curvature CP to R. Then

$$\text{Angle of incidence} = \text{OPR},$$

$$\text{Angle of refraction} = \text{IPR}.$$

As before, circular measure of $\angle$ OPR = $\mu \times$ circular measure of $\angle$ IPR.

Also, since $\angle$ OPR is the exterior angle of the triangle OPC, we have

$$\angle \text{OPR} = \angle \text{POC} + \angle \text{PCO}.$$

Similarly $\angle \text{IPR} = \angle \text{PIC} + \angle \text{PCI}.$

If we take

$$\text{CP} = \text{CD} = \text{R},$$

$$p\text{O} = \text{DO (approximately)} = u,$$

$$p\text{I} = \text{DI (approximately)} = v,$$

$$\text{P}p = d,$$

we have

$$\text{Circular measure of } \angle \text{OPR} = \frac{d}{u} + \frac{d}{R} = d\left(\frac{1}{u} + \frac{1}{R}\right)$$

$$\text{,, ,, } \angle \text{IPR} = \frac{d}{v} + \frac{d}{R} = d\left(\frac{1}{v} + \frac{1}{R}\right)$$

$$\therefore d\left(\frac{1}{u} + \frac{1}{R}\right) = \mu d\left(\frac{1}{v} + \frac{1}{R}\right).$$

It will at once be seen that this equation differs, in the sign of a particular term, from that previously obtained. It may be noticed, however, that if we agree to measure all lengths from the bounding surface of the medium, in Fig. 1 R, u, and v are all measured *in the opposite direction to that pursued by the incident light*, whilst in Fig. 2 u and v are measured as previously, whilst R is measured *in the direction pursued by the incident light*.

If we agree to consider all distances measured from the surface in a direction opposite to that pursued by the incident light as positive, distances measured in the reverse direction being negative, we see that in Fig. 2 R will be negative. With this convention we have

$$d\left(\frac{1}{u} - \frac{1}{R}\right) = \mu d\left(\frac{1}{v} - \frac{1}{R}\right),$$

$$\therefore \frac{1}{R} - \frac{1}{u} = \mu\left(\frac{1}{R} - \frac{1}{v}\right)$$

—the same equation as previously obtained.

It must be remembered that either u, v, or R may be negative: u negative will correspond to light converging on the lens; v negative will correspond to a real image formed in the denser medium. The student may be left to draw diagrams for these cases.

2. REFRACTION BY A LENS.—When a lens is employed we must take into account both the bounding surfaces.

Taking u_1 as the distance of the object from the first surface, and v_1 as the position of the image, R_1 being the radius of curvature of the first surface, we have from (1)

$$\frac{\mu}{v_1} = \frac{\mu - 1}{R_1} + \frac{1}{u_1}.$$

Now v_1 (which may be either + or −, according to circumstances) may be taken as fixing the position of the image formed by refraction at the first surface, and this image in its turn serves as an object from or to which the light proceeds till it is refracted at the second surface. The formula to be used with the second surface is precisely of a similar nature to that employed in case of the first one. Writing v_2, R_2, and u_2 as fixing the position of the image, centre of curvature, and object, with regard to the second surface of the lens, we have

$$\frac{\frac{1}{\mu}}{v_2} = \frac{\frac{1}{\mu} - 1}{R_2} + \frac{1}{u_2}.$$

We substitute $\frac{1}{\mu}$ for the μ in (1), since the light is now passing from the denser to the rarer medium. Hence, remembering that $u_2 = v_1$, as above explained, we have

$$\frac{1}{v_2} = \frac{1 - \mu}{R_2} + \frac{\mu}{u_2} = \frac{1 - \mu}{R_2} + \frac{\mu}{v_1}$$

$$= \frac{1 - \mu}{R_2} + \frac{\mu - 1}{R_1} + \frac{1}{u_1}.$$

$$\therefore \frac{1}{v_2} - \frac{1}{u_1} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right).$$

Now u_1 may be taken as fixing the position of the object, and v_2 as fixing the position of the image, with respect to the *lens as a whole*. Therefore we may write

$$\frac{1}{V} - \frac{1}{U} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

if V = distance of the image (+ or −, according to circumstances) from the lens.

U = distance of object (+ or −, according to circumstances) from the lens.

R_1 and R_2, either of which may be + or −, are the respective radii of curvature of the first and second surfaces of the lens.

Let $U = \infty$, then the incident light is parallel, and the position of the image will be fixed by

$$\frac{1}{V} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right).$$

The position of the image in this case is termed the principal focus of the lens. If we write

$$\frac{1}{F} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad . \quad . \quad . \quad . \quad (3),$$

we have the general formula

$$\frac{1}{V} - \frac{1}{U} = \frac{1}{F}.$$

F is termed the focal length of the lens.

3. REFRACTION BY A PAIR OF LENSES.—For the first lens we have

$$\frac{1}{V} - \frac{1}{U} = \frac{1}{F}.$$

If V′, U′, F′ refer to a second lens, placed close to the first, we have, since U′ = V,

$$\frac{1}{V'} - \frac{1}{U'} = \frac{1}{V'} - \frac{1}{V} = \frac{1}{F'}.$$

$$\therefore \frac{1}{V'} = \frac{1}{F'} + \frac{1}{V} = \frac{1}{F'} + \frac{1}{F} + \frac{1}{U},$$

$$\therefore \frac{1}{V'} - \frac{1}{U} = \frac{1}{F'} + \frac{1}{F} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4).$$

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4. Achromatic Combination.—We must now remember that with any kind of glass the refractive index for blue light is always greater than the same quantity for red light.

Let μ_{1r}, μ_{1b} be the refractive indices, for red and blue light respectively, of the glass composing the first lens, μ_{2r}, μ_{2b} representing similar quantities for the second lens. Then U being the distance of the object, illumined with white light, from the pair of lenses, in order that the combination should be achromatic, $\frac{1}{V'}$ in (4) must be the same for red as for blue light—that is, the image formed by the blue light must coincide with that formed by the red light.

For red light we have from (4) and (3)

$$\frac{1}{V'} - \frac{1}{U} = \frac{1}{F'} + \frac{1}{F} = (\mu_{2r} - 1)\left(\frac{1}{R'_1} - \frac{1}{R'_2}\right) + (\mu_{1r} - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad (5),$$

where R'_1, R'_2 are the radii of curvature of the second lens, whose refractive index for red light is μ_{2r}.

For blue light,

$$\frac{1}{V'} - \frac{1}{U} = (\mu_{2b} - 1)\left(\frac{1}{R'_1} - \frac{1}{R'_2}\right) + (\mu_{1b} - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad . \quad . \quad . \quad . \quad (6).$$

Subtracting (5) from (6), we have

$$(\mu_{2b} - \mu_{2r})\left(\frac{1}{R'_1} - \frac{1}{R'_2}\right) + (\mu_{1b} - \mu_{1r})\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = 0 \quad . \quad (7).$$

This may also be written, if we take μ_1 as representing the refractive index of the first lens for rays in the middle of the spectrum, μ_2 having a like signification for the second lens—

$$\frac{\mu_{2b} - \mu_{2r}}{\mu_2 - 1}(\mu_2 - 1)\left(\frac{1}{R'_1} - \frac{1}{R'_2}\right) + \frac{(\mu_{1b} - \mu_{1r})}{\mu_1 - 1}(\mu_1 - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = 0 \quad . \quad (8),$$

or

$$\frac{\mu_{2b} - \mu_{2r}}{\mu_2 - 1}\frac{1}{F'} + \frac{\mu_{1b} - \mu_{1r}}{\mu_1 - 1}\frac{1}{F} = 0.$$

The quantity $\frac{\mu_{2b} - \mu_{2r}}{\mu_2 - 1}$ is termed the *dispersive power* of the glass composing the lens.

We are now in a position to obtain a numerical solution of the problem.

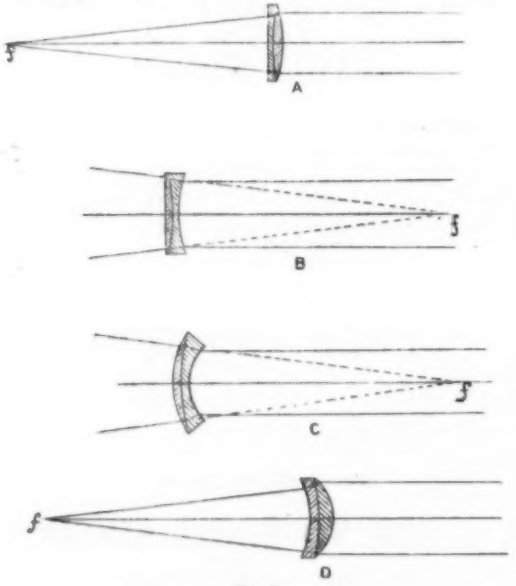

Fig. 3.

The crown-glass lens is in each case to the right of the combination.

There are, as a matter of fact, four different combinations which will fulfil the requirements stated. These combinations are shown in Fig. 3. It will be noticed that part of the ambiguity of the question is due to the fact that it is not stated whether the principal focus of the combination is to be real (A and D) or virtual (B and C).

Let us assume that the light falls first on the crown-glass lens. Then, if the focus is on the opposite side of the lens to that on which the light first falls (A and D), we must take the focal length as − 40. In the other cases (B and C) the focal length must be taken as + 40. Further, if the centre of curvature of the interface lies on the same side of the lens as that on which the light first falls (A and C), we must take $R_2 = R'_1 = 25$; in B and D, $R_2 = R'_1 = -25$.

Also, for the flint-glass lens,

$$\frac{\mu_{2b} - \mu_{2r}}{\mu_2 - 1} = 0{\cdot}45, \qquad \mu_2 - 1_1 = 0{\cdot}6.$$

For the crown-glass lens,

$$\frac{\mu_{1b} - \mu_{1r}}{\mu_1 - 1} = 0{\cdot}21, \qquad \mu_1 - 1 = 0{\cdot}5.$$

We have therefore the following sets of equations for the various combinations represented in Fig. 2:—

A
$$-\frac{1}{40} = {\cdot}6\left(\frac{1}{25} - \frac{1}{R'_2}\right) + {\cdot}5\left(\frac{1}{R_1} - \frac{1}{25}\right)$$ from (4), taking U = ∞, and substituting the values of F and F' for the middle of the spectrum from (3).

$$0{\cdot}45 \times 0{\cdot}6\left(\frac{1}{25} - \frac{1}{R'_2}\right) + 0{\cdot}21 \times 0{\cdot}5\left(\frac{1}{R_1} - \frac{1}{25}\right)$$ from (8).

Solving for R_1 and R'_2, we get

$R_1 = -18{\cdot}6$ cms. $\qquad R'_2 = +286$ cms.

B
$$\frac{1}{40} = {\cdot}6\left(-\frac{1}{25} - \frac{1}{R'_2}\right) + {\cdot}5\left(\frac{1}{R_1} + \frac{1}{25}\right)$$

$$0{\cdot}45 \times 0{\cdot}6\left(-\frac{1}{25} - \frac{1}{R'_2}\right) + 0{\cdot}21 \times 0{\cdot}5\left(\frac{1}{R_1} + \frac{1}{25}\right) = 0.$$

Solution, $R_1 = +18{\cdot}6$ cms. $\qquad R'_2 = -286$ cms.

C
$$\frac{1}{40} = {\cdot}6\left(\frac{1}{25} - \frac{1}{R'_2}\right) + {\cdot}5\left(\frac{1}{R_1} - \frac{1}{25}\right)$$

$$0{\cdot}45 \times 0{\cdot}6\left(\frac{1}{25} - \frac{1}{R'_2}\right) + 0{\cdot}21 \times 0{\cdot}5\left(\frac{1}{R_1} - \frac{1}{25}\right) = 0.$$

Solution, $R_1 = +7{\cdot}47$ cms. $\qquad R'_2 = +13{\cdot}1$ cms.

D
$$-\frac{1}{40} = {\cdot}6\left(-\frac{1}{25} - \frac{1}{R'_2}\right) + {\cdot}5\left(\frac{1}{R_1} + \frac{1}{25}\right)$$

$$0{\cdot}45 \times 0{\cdot}6\left(-\frac{1}{25} - \frac{1}{R'_2}\right) + 0{\cdot}21 \times 0{\cdot}5\left(\frac{1}{R_1} + \frac{1}{25}\right) = 0.$$

Solution, $R_1 = -7{\cdot}47$ cms. $\qquad R'_2 = -13{\cdot}1$ cms.

Emtage gives two values, 13·7 and 76·7 cms., which we have not been able to confirm.

It may be remarked that the lens A (Fig. 3) is the most usual form of an achromatic combination of the present description.

Daisy.—If an oz. of water at 0° is mixed with an oz. of water at 70° C., the result will be 2 oz. at 35°.

In cooling down from 70° C. to 56° C., 10 oz. of water will have given out sufficient heat to raise 1 oz. of water 10 × 14° C. = 140° C.; but 1 oz. of ice is simply raised from 0° C. to 56°, instead of to 140° C., hence some of the heat given out by the water at 70° has not been utilised in raising the temperature of the ice, but has been occupied in changing the state of the substance from solid water to liquid water. This we express by saying that the heat in question has become latent—namely, sufficient heat to raise 1 oz. of water from 0° to 84° C., or, in round numbers, 80° C.; from which we learn that the latent heat of liquefaction of ice is 80, meaning that as much heat is required to convert 1 oz. of ice at 0° into 1 oz. of water at the same temperature as would suffice to raise 1 oz. of water from 0° C. to 80° C., or 80 oz. of water from 0° to 1° C. (See Cartwright's *Section I. Physiography*, p. 117.)

J. E. W.—The phenomenon in question is due to the fact that the crescent moon always points with the line of greatest width towards the sun, the horns of the crescent being turned from the sun, from which they are equidistant.

Cymru.—The condition of the silver described by you is very puzzling. An attempt has been made to repeat your experiment, but entirely without success. Can you forward a specimen, in order that a thorough examination of it may be made? Are you quite sure that no foreign substance was introduced?

A. W. B.—See page 596.

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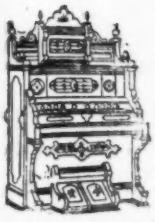

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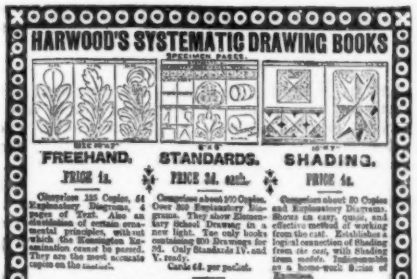

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THE EDITOR'S TABLE

ADAM AND CHARLES BLACK.

The Englishwoman's Year-Book and Directory, 1899. First Year of New Issue. This may be taken as an outcome and evidence of what is referred to in the *Almanach Hachette* as *Le mouvement Feministe*, and it is a notable landmark of the growth of that movement in our own country. The spirit of the work may be gathered from the fact that it opens with "Education," while the "Royal Family" is relegated to a position on page 161 below that of "Women Hairdressers" and "Etiquette Books." The thoroughness of the work is beyond doubt. The education of women, apart from ample information regarding all forms of professional training, occupies over forty fairly solid pages, and other subjects receive no less exhaustive treatment. The "List of Medical Women" alone occupies eight pages. One of the articles, on "Elementary Teaching as a Profession for Women," informs us that "an outsider" (that is, one who becomes teacher without any previous training) is "looked upon with suspicion and jealousy,"—which suggests many thoughts needless to express.

The book may be regarded as an excellent compendium of pretty nearly all that women, *qua* women, are likely to require in a book of reference. Its scope may be judged from the fact that thirteen pages of three columns each are required for the index. The appearance of the volume is all that could be desired.

THE CAMBRIDGE UNIVERSITY PRESS.

The Teaching of Modern Foreign Languages. By Dr. Karl Breul. This little work marks an epoch in modern language teaching in England. Dr. Breul lays down four conditions for the necessary improvement in teaching modern foreign languages:—

1. "More time should be allotted to the study."
2. "This time should be used more systematically with special reference to the educational needs of the pupils, and not merely with regard to the requirements of certain examinations." "The modern tongue should not be treated like the classical dead languages; a *viva voce* test should, as far as possible, be insisted on."
3. "None but duly-qualified teachers should be entrusted with the teaching of modern languages."
4. "There should be a more general agreement as to the chief points of method to be adopted, and the books to be read in the school."

The chapter on Methods is clear, and characterised throughout by the writer's admirable sense and thorough grasp of the subject. He discusses pronunciation, spelling, grammar idioms, vocabulary, conversation, reading, and he describes the kind of reading book he proposes to put into the hands of the young student of foreign languages.

This book should contain, in addition to the selected prose and verse, good clear maps of the country in which the language is spoken; tables of foreign measures, weights, and moneys, together with English equivalents; pictures of flags and ensigns of the foreign nation; enumeration of the principal ranks and titles, together with the proper forms of address; letters of various kinds, social and commercial; and a list of common abbreviations used in the foreign languages.

A bibliographical appendix is added, together with a reference library of a school teacher of German.

It is impossible in a short space to sum up the value of this little work. The language teacher will find in it a mine of suggestions.

CHAPMAN AND HALL.

Measurement and Weighing: A First Year's Course in Elementary Practical Physics. By E. Edser. As stated in the preface, this work is the outcome of an attempt to provide a first year's course in practical physics; and the experiments having been successfully performed by students beginning their science training, the book will be found very useful and suitable for such a purpose. Teachers of the subject will find much useful information in its pages. Commencing with simple linear measurement, the subject of mensuration receives careful attention, as also the use and commercial values of the trigonometrical ratios.

One of the most important parts of the book consists of a very useful introduction to the subject of logarithms, and by simple, graphic methods the student is enabled not only to use these valuable aids to calculation, but also to see clearly how to calculate, if necessary, the logarithms of numbers.

A list of some ninety experiments is given, with full explanations as to carrying them out. These include not only linear and angular measurements, areas and volumes, but also well-arranged experiments on mass and density. Probable errors of observation are pointed out, and also means of obviating them.

Unfortunately the printing of the book is unsatisfactory, and the same remarks apply to the illustrations.

THE CLARENDON PRESS.

Practical Work in Physics: IV. Magnetism and Electricity. By W. G. Woollcombe, M.A., B.Sc. This book (Part IV.) on magnetism and electricity forms one of an excellent series of books on practical subjects by the same author. In its hundred and ten pages numerous practical experiments are given, requiring, as a rule, only the simplest apparatus. The experiments are carefully and judiciously selected, and well calculated to give the student performing them a far better insight into the subject than could be obtained by any amount of mere book reading. The object of all experimental work should be to inculcate habits of close observation and accurate reasoning on results obtained. The book before us will certainly do much to effect this desirable object. Both teachers and students will find it very useful. Printing and illustrations are alike excellent.

A. M. HOLDEN.

The Art of Writing English. By Professor Meiklejohn. To the student who anticipates finding a simple and easy road to the writing of good English, and to the teacher who expects, from past experience of such works, to find a wearisome list of useless rules, this book will be a disappointment and a surprise: a disappointment to the former, because Professor Meiklejohn is far too wise to attempt the impossible; a surprise to the latter, because he will find such shrewd advice and common sense as are usually conspicuous by their absence in books which profess to teach the art of writing.

An "art" it certainly is, but one that is not mastered by committing to memory pages of complicated directions, and in which a student can no more attain efficiency by mere knowledge of theory than an artist can become President of the Academy by reading libraries of art literature. Some rules are doubtless necessary—a workman must know the use of his tools—but success lies in *doing*, in continual attempts resulting possibly in repeated failures, but leading ultimately to inevitable success.

These are the principles on which this book is based. We recommend every student to read carefully the excellent prologue, and to follow implicitly the directions laid down for his guidance. He may not become a past master in the art of composition—that depends upon individual taste and extent of reading—but he cannot fail to improve his style, and certainly will avoid those glaring errors which are at once the bane of the examiner and a source of much amusement.

All that is worth saying on such topics as Idioms, Synonyms, Paraphrasing, Essay Writing, Précis Writing, Figures of Speech, Style, etc., is here said. The exercises are numerous, well arranged, and have a definite aim, although we must demur from the over-modest remark in the preface that "Whatever utility may exist in the book is to be found chiefly in the exercises." In our opinion, the practical advice is in itself excellent.

The author would perhaps have done additional service to the young and isolated student had he pointed out some two dozen English classics which would repay careful study. It is the lack of knowing *what* to read that leads in a great measure to the ignorance of *how* to write.

We congratulate Professor Meiklejohn on having added another to the list of eminently useful text-books bearing his name, and we venture to predict that this last will be by no means the least successful.

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Second Stage Mathematics. Edited by W. Briggs, M.A., LL.B., F.C.S., F.R.A.S. This book—a member of Clive's Organised Science Series—contains "the additional Algebra and Euclid, with the Trigonometry required for the Second Stage" of the requirements of the Science and Art Department. It is, in the main, a compilation from existing manuals published by Clive—the Euclid being taken almost bodily from Deakin's edition, with Mr. Deakin's most interesting notes usually omitted; while the Trigonometry consists of excerpts from Briggs's and Bryan's useful manual, which has been recently reviewed by us; and the Algebra is from the book noticed below.

We do not greatly care for books limited to a special syllabus whose aim is to impart, not knowledge, but a certificate. For those, however, who are in want of a book for this especial purpose, and are not afraid to confess it, this compilation may be heartily commended. It is clear, compact, and well executed. The figures in the Euclid section are a weak point. Thick lines are rightly used to represent the data, thinner lines for those added in course of proof. This distinction is ignored, however, on pp. 29, 30, 109, 111, 123, 125, and 131. Occasionally, too, a G in the figure too much resembles a C, as on p. 46.

A Middle Algebra, based on the Algebra of Radhakrishnan. By W. Briggs, M.A., F.C.S., F.R.A.S., and G. H. Bryan, Sc.D., F.R.S. This is a thoroughly good book, which we have pleasure in commending heartily to our readers. Commencing with the theory of indices, it treats of surds, inequalities, ratio, proportion, variation, equations, maxima and minima, progressions, some other simple series, logarithms, interest and discount, permutations, combinations, mathematical induction, and the binomial theorem for a positive index. It thus forms an admirable one year's course for those who have mastered the smaller Hall and Knight, or Hamblin Smith, or Colenso, or Todhunter; and if a collection of miscellaneous examples were added, it would form the best text-book we know for the requirements of the Senior Cambridge Locals, Senior Oxford Locals, or London Intermediate Examinations. For the last-named examination, however, we should have thought a chapter on annuities advisable. The chief novelties are found in the early introduction of inequalities, the elaborate analysis of the meanings of "zero" and "infinity," the very complete exposition of the theory of quadratics, the chapter on maxima and minima, and the masterly treatment of permutations and combinations.

The book claims to be a "Chrystal for Beginners," and it is curious that at the very time at which there has been made an attempt on the part of Professor Chrystal to render himself intelligible to beginners—an attempt which ends, we regret to say, in partial failure—we should be able to record some success in the same direction on the part of others. Yet we are profoundly convinced that complete success will not be attained unless a greater use is made of *graphs*. In the present treatise these are never mentioned, although they would have shed a flood of light on chapter xiii. Several other minor criticisms occur to us. There is a misprint in line 8 of the preface. The venerable proof on p. 134 would be better omitted. It is not wholly satisfactory, for it does not apply to a quadratic with one infinite root ($a = 0$), and it is very puzzling to a beginner. The proof of § 205—for which the authors, we believe correctly, claim originality—is much inferior to that given in Hall and Knight (Higher Algebra, § 253), to which the objections raised in our authors' preface do not seem to us to apply. We do not like the phrase "impossible solutions" of § 142. The two words seem mutually contradictory.

But we repeat that the book is a thoroughly good one, and wonderfully cheap.

HACHETTE AND CIE., PARIS.

Almanach Hachette: Petite Encyclopédie populaire de la Vie pratique. It would be hard to imagine a more complete annual than this, or one which is a better example of the proverb quoted on its title-page, *Patience vaine tout*. The calendar and diary are models of completeness, the view of the constellations given for each month being a special feature. There are admirable summaries for the past year of politics, diplomacy, education, legislation, religion, economics, agriculture, meteorology, science, military affairs, and a host of other useful compilations. *La Vie pratique* is a useful appendix, containing short articles on literature, art, science, domestic life, sports, and the like. The whole work, which is nevertheless of convenient dimensions, forms a veritable encyclopædia of information, and is enriched with forty-three maps and over two thousand illustrations. Special praise may be given to those showing the relative size of the world's navies, and the growth of population in the nations of Europe.

Half-Hours with Modern French Authors, and **Unseen Passages from Modern French Authors.** By J. Lazare. The titles of these two excellent little books sufficiently describe them. It remains only to bear testimony to the judgment of M. Lazare, which we do without stint; for he has produced two books that are veritable *bonnes-bouches*, and which we advise all students of French to procure.

JOHN MURRAY.

The Groundwork of Science. By St. George Mivart, M.D., Ph.D., F.R.S. This is the initial volume of the Progressive Science Series, of which the English editor is F. E. Beddard, F.R.S., his American colleague being Professor J. M'K. Cattell. The series differs very materially from an ordinary series of text-books on science, inasmuch as the more philosophic side of the various subjects is put in the foreground. This will be apparent from the list of volumes which are to follow close upon the heels of *The Groundwork of Science*. These are: *Earth Structure*, by Professor Geikie; *The Study of Man*, by Professor Hadden; *Volcanoes*, by Professor Bonney; *The Reproduction of Living Bodies*, by Professor Marcus Hartog; *The Animal Organ*, by the Editor; *Man and the Higher Apes*, by Dr. A. Keith; *Heredity*, by J. A. Thomson; *Science and Ethics*, by M. Berthelot; *Vertebrate Palæontology*, by Professor Cope. In the volume before us Dr. Mivart discusses what he terms Epistemology, a word coined from the Greek Ἐπιστήμη, "understanding," and λογος, a "discourse," which denotes the groundwork of science both within us and without us. The book is divided into ten chapters, the most interesting of which are those dealing with (1) the objects of science (chap. iii.), (2) the methods of science (chap. iv.), (3) the psychical antecedents of science (chap. vi.), (4) intellectual antecedents of science (chap. viii.). It is very plainly evident in the pages of his book that Professor Mivart possesses two admirable traits: he is conspicuously independent in his opinions; he is scrupulously careful to do justice to the opinions of those who have the misfortune—or the reverse—to differ from him. This comes out most distinctly in his treatment of Bishop Berkeley and the idealistic school of thought. Not content with clearly stating the position of those who believe, with the worthy Bishop of Cloyne, that objects are mere bundles of sensations, and that there is no warrant for our belief, however strong, in the existence of an external world of concrete objects, he is careful to remind his readers of the fact that it is easy to laugh at this doctrine, but quite another matter to refute it; adding that there must be something in a system that has attracted, and continues to attract, so many distinguished adherents both here and abroad. Incidentally Professor Mivart pays a great compliment to Berkeley and the English school of philosophy, which is, he affirms, responsible for the direction taken by German philosophic thought in its developments from Kant to Schopenhauer. The author holds that we intuit the fact that there is an external world of objects, and certainly it must be conceded that plain people cannot be persuaded that objects are non-existing fictions of the fancy. We should like to follow Professor Mivart through each of his ten thoughtfully-written chapters; but the task would be a long one, and the space required would be much more than can be made available. We must, however, bear testimony to the clearness of the exposition, and to the logical sequence of the various sections. The following quotation will serve as an exemplar alike of Professor Mivart's lucid style and of his doctrine:—

"He who with an unprejudiced mind ponders over the phenomena which the universe lays open to his gaze can hardly, we think, fail to discover immanent therein an activity the results of which harmonise with man's reason—an activity which is orderly and disaccords with blind chance, or 'a fortuitous concourse of atoms,' but which, nevertheless, is not an intelligent activity such as is our own, but one that acts in modes which are different from those we should adopt in order to attain similar ends. It is sometimes directed against reason as latent in nature that we see in all directions so much waste, and that of so great a multitude of organic germs very few attain maturity. But this objection is indeed an anthropomorphic one, and would imply that the cause of all things is a contriving human mind! But the non-human rationality, of which nature affords so many hints and glimpses as everywhere pervading it, is a universal cause and reason, and, if we may speak of 'purpose' in this connection, its purpose is fulfilled in every event, and thus no waste is possible. Every seemingly 'wasted' germ fulfils other purposes of nature, as the spores of our ancient coal-fields now help the man of science to cross oceans in quest of fresh material for study."

A word of praise must be given to the publishers for the tasty, serviceable way in which the book has left their hands.

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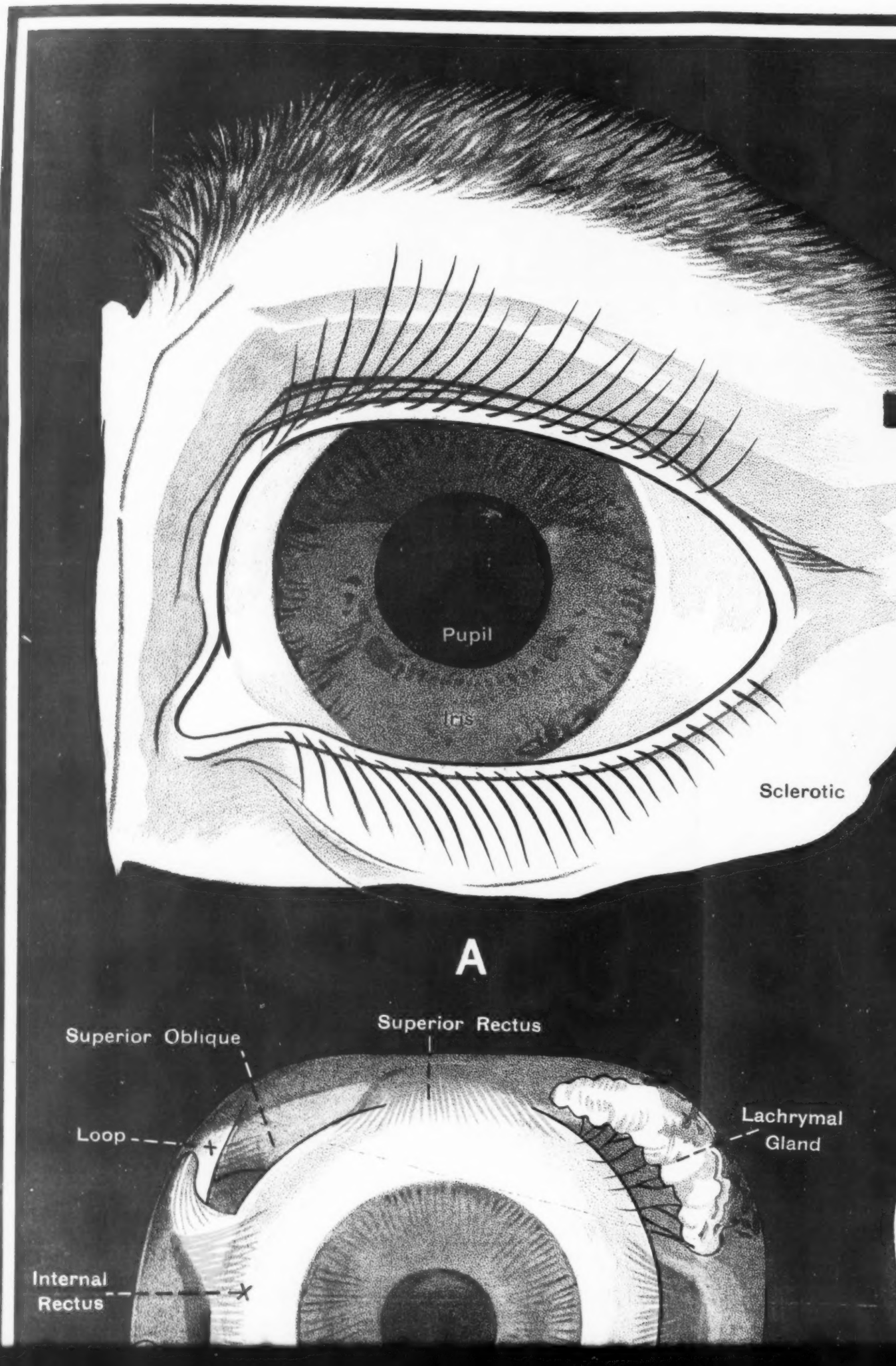
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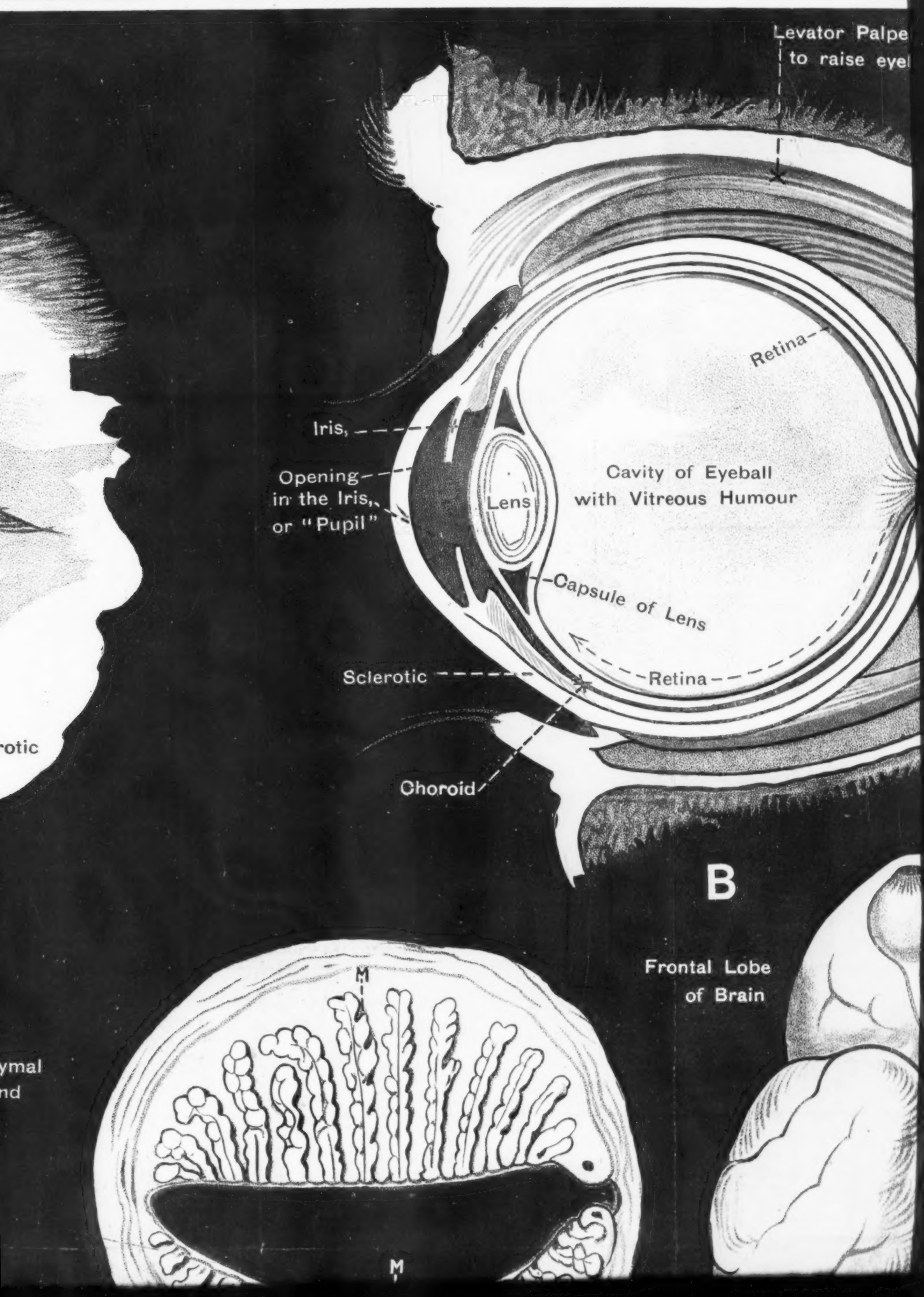

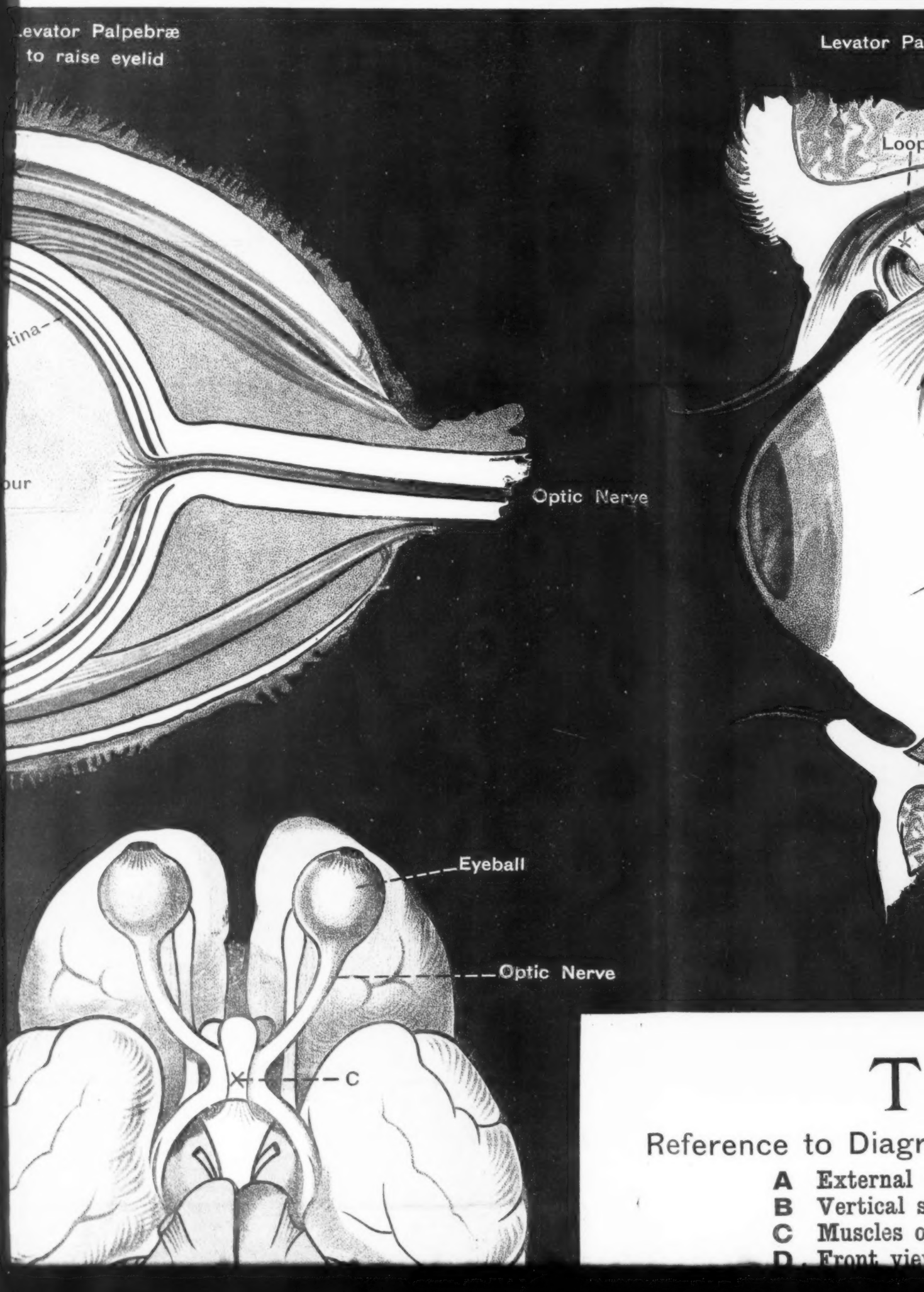

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B Vertical s
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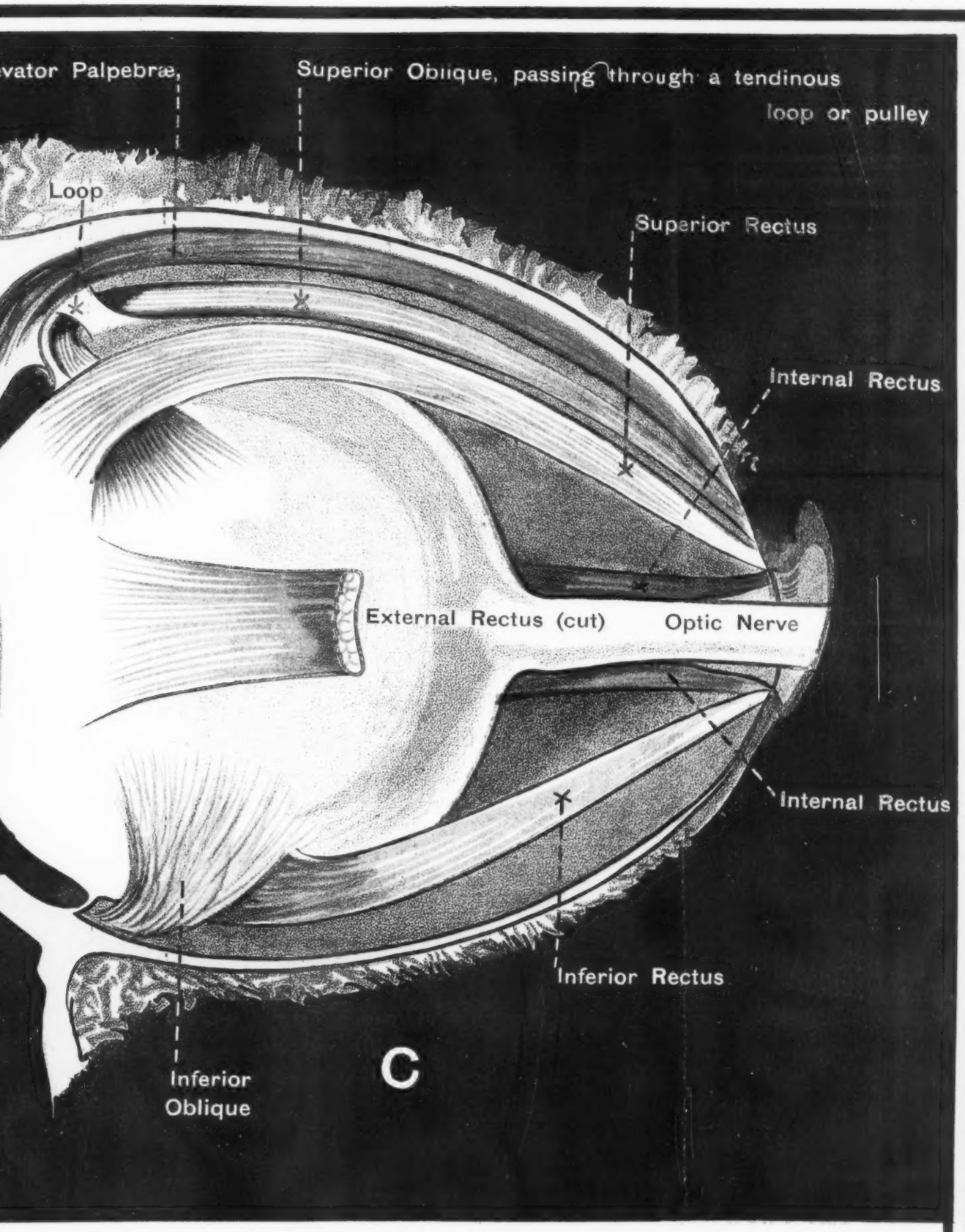

THE EYE.

Diagrams—

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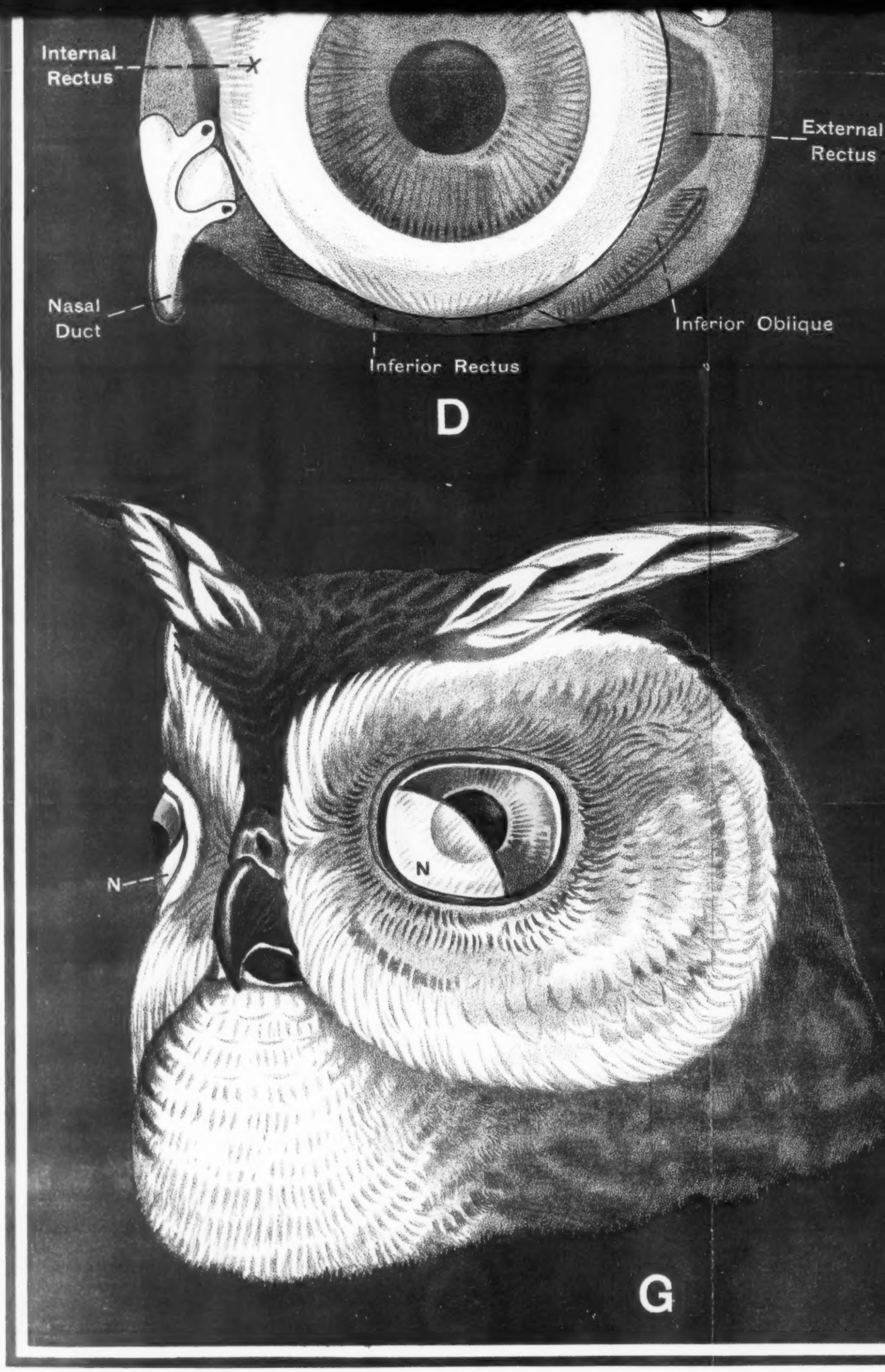
ertical section through the eye.
uscles of the eye and the eyelid.
ront view of eye (eyelid removed).



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Front View of eye (eyelid removed).

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Rectus

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Parietal
Lobe

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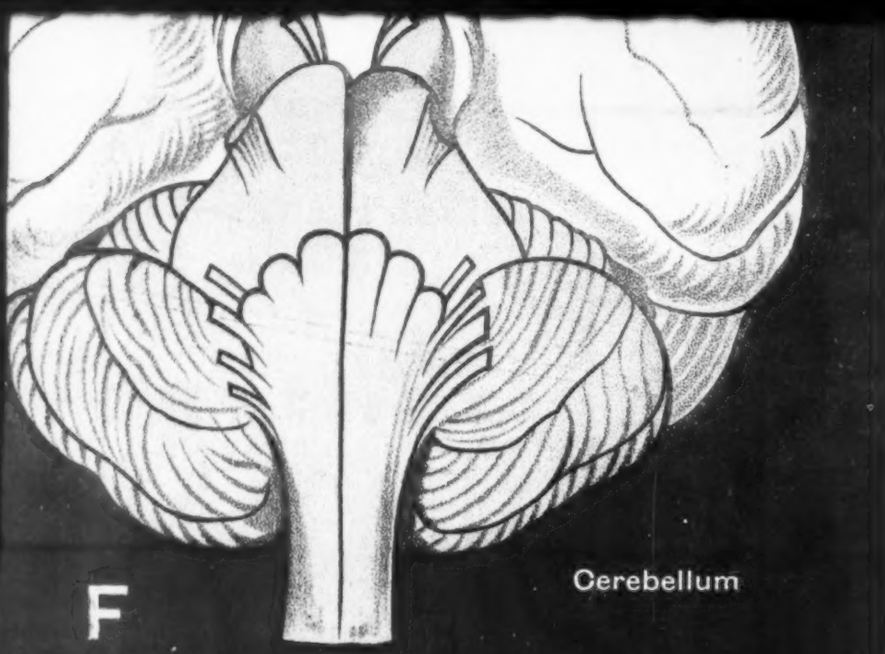

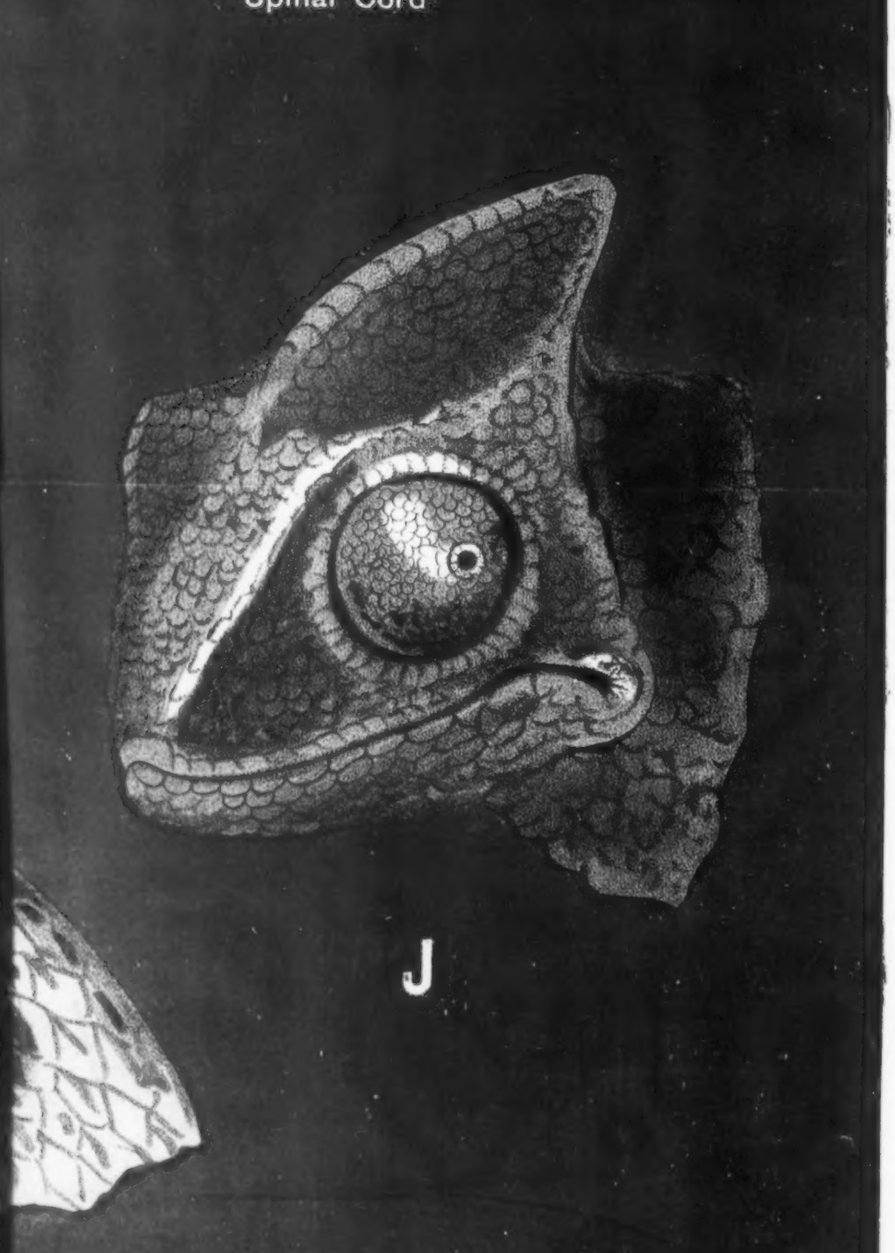

Reference to Diagra

A External vi
B Vertical sec
C Muscles of
D Front view
E Internal vie
F Under-surfa
G Eye of Owl,
H Eye of Deer
I Eye of Horn
J Eye of Cha

The eye is the organ of v
objects are perceived through
retina, an extremely sensitive
of the interior of the eyeball,
the *optic nerve* to certain parts

The delicate structures of
interior of the eye-socket, or o
eyeball is filled by three tra
the *vitreous humour*, the *crystall*
cornea is a coloured membran
—which regulates the admissi
structures are three coverings
globular form of the eye; th
with vessels and nerves; the
the image of external objects.

The movements of the eye
sclerotic, and inserted into th
and external *recti* muscles; an
are also controlled by muscles
the inferior. The eye is also
the parts adhering. The large
secrete a fluid by which the e

The eyes of animals, birds
related to the habits of the cr
be found by careful search in
(the *Tarsius*) are, relatively to
undergoes change. It may be
others; or it may be upright,
the eye, in the form of a third
but specially in the night-lovin
serves to protect the eye, as
in many animals and in man,
extremely prominent, but the
of each other.

HYSIOLOGY.

Diagrams—

ernal view of the human eye.
sical section through the eye.
cles of the eye and the eyelid.
t view of eye (eyelid removed).
rnal view of eyelid, showing meibomian glands.
er-surface of brain, showing optic nerves.
of Owl, showing nictating membrane (N).
of Deer: oval iris and transverse pupil.
of Horned Viper: round iris and perpendicular pupil.
of Chameleon.

gan of vision. Colours, forms, distances, and relationships of external through the medium of light of varying intensity acting upon the nsitive expansion of the optic nerve, which covers the posterior part eyeball, the impression or image received thereon being conveyed by in parts of the base of the brain (F).

tures of the eye are protected externally by the eyelids, and in the ket, or orbit, by small masses of fat and tissue. The centre of the ree transparent bodies, which transmit and refract light—namely, *crystalline lens*, and the *aqueous humour*. Between the lens and the membrane—the *iris*—in the centre of which is an opening—the *pupil* admission of light into the interior of the eye. Surrounding these overings: the outer—the *sclerotic*—is dense and tough, preserving the eye; the *choroid*, with the iris, is a thin membrane well supplied s; the *retina* is a highly sensitive structure, upon which is thrown objects.

the eye are controlled by six muscles—four being attached to the into the base of the orbit, namely, the superior, inferior, internal, cles; and two *oblique* muscles, the superior and inferior. The eyelids muscles—the upper one by the superior *levator*, and the lower by is also provided with glands, which secrete moisture, and so prevent he largest—the *lachrymal*—secretes the tears. The *meibomian* glands h the external surface of the eye is kept moist.

ls, birds, reptiles, and fishes present many curious forms, which are f the creatures. Those of the mole are so small that they can only arch in the dense fur. Those of certain species of lemur-like animals ively to the body of the animal, extremely large. The pupil also may be transverse or horizontal, as in deer, goats, sheep, and many upright, as in many snakes and lizards. An additional protection to a third eyelid—the *membrana nictitans*—is found in almost all birds, ght-loving owls. It passes over the eyeball from the inner side, and eye, as well as to modify the light. Traces of it are also present in man, but it is not functional. The eyes of the chameleon are out the opening is very minute. They can be moved independently

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